

Some studies of language use and class inclusion

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Contents

Summary	(ii)
Acknowledgements	(iv)
Chapter 1 Prospect	1
Chapter 2 Class inclusion and language	5
Chapter 3 Studies of language	32
Experiment 1: Topicalization in discourse I	
Experiment 2: Topicalization in discourse II	
Experiment 3: Topicalization and definiteness in discourse	
Experiment 4: Definiteness and presupposition in discourse	
Chapter 4 Studies of class inclusion	74
Experiment 5: Inclusion and familiarity of material	
Experiment 6: Naming and comparing I	
Experiment 7: Naming and comparing II	
Experiment 8: Replications (Experiment 7)	
Experiment 9: Referential clarification of subclass terms in inclusion questions	
Experiment 10: Referential restriction of class terms in inclusion questions	
Experiment 11: Referential clarification of class terms in subtraction questions	
Experiment 12: Referential clarification of class terms in inclusion questions I	
Experiment 13: Referential clarification of class terms in subtraction and inclusion questions	
Experiment 14: Referential clarification of class terms in inclusion questions II	
Experiment 15: Referential clarification of class terms in inclusion questions III	
Experiment 16: Referential clarification of class terms in inclusion questions IV	
Chapter 5 Retrospect	162
General implications	175
Notes	180
References	200

Summary

This dissertation considers some features of language in relation to Piaget's account of class inclusion, the 'decisive test' of a fundamental ability in any theory of cognitive development: the child's ability to classify.

Noticing a general disparity between the results of Piaget's studies of class inclusion: which suggest that the child cannot function on a complex cognitive level until about age 8 years when the solution of such inclusion problems is customarily observed, and recent studies of language acquisition: which suggest that the child can function on a complex linguistic level from about age 4 years, it is suggested that such phenomena in one and the same individual appear conceptually discomfiting.

It is then noted that although Piaget discounts any fundamental relationship between the child's linguistic and cognitive abilities in relation to the problem of inclusion, his studies have nevertheless employed language as a vehicle for inquiry. While this implies examination of the role of language by varying appropriate linguistic aspects of class inclusion tasks, there appears no way of deciding, a priori, which linguistic aspects might be appropriately varied.

Due to the lack of an established literature on this question, the problem is approached indirectly by turning to studies in the psychology of language where considerable attention has recently

been drawn to the importance of language structure (syntax). However the results of four experiments suggest the relatively greater importance of semantic aspects of language which reflect features of language use in discourse.

When attention is drawn to semantic aspects of class inclusion, four anomalies in Piaget's account of inclusion can be noticed. In an attempt to reduce these anomalies, the results of twelve experiments on class inclusion are presented. These experiments suggest that the child's difficulties with inclusion problems do not arise through cognitive inability to compare class and subclass (as is suggested in Piaget's account), but rather through difficulties with the language associated with class inclusion problems. The child appears to use the language in a way different from the adult, and the way in which the child uses the language can be seen to be a function of context, type of utterance, and, especially, clarity of reference of terms employed in utterances.

Besides specific implications for the problem of class inclusion itself, the studies reported in this dissertation would seem to have some wider implication for studies which employ language as a vehicle for inquiry into cognitive abilities, and for studies of semantic development.

In sum, the dissertation concludes that an understanding of any relationships between linguistic and cognitive abilities in the child is dependent on an understanding of how the child uses the language.

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Chapter 1

Prospect

Language and cognition have long been sources of fascination, and the present century has witnessed their study both within and between apparently separate disciplines such as philosophy, psychology and linguistics. For example, it has been proposed that consideration of the nature of language alleviates philosophical perplexity (Wittgenstein, 1953); that consideration of language provides insight into the working of the human mind (Chomsky, 1968); that the particular language we possess determines the way in which we think (Whorf, 1956); that in ontogeny, language functions as a cognitively ego-centric instrument which becomes progressively socialized (Piaget, 1926); or as a social instrument which becomes progressively individualised (Vygotsky, 1962); that in postulating linguistic grammars we ask whether such grammars

could ever be acquired by natural language users (Chomsky, 1957, 1960, 1965); and that before attempting to extend learning theories fashioned in studies of non-human species to human language acquisition (as in Skinner, 1957), we explore both the possibility that human language is unique (species specific) by virtue of the typical novelty of its utterances (Chomsky, 1959; Lenneberg, 1967), and that postulation of operant conditioning procedures apparently excludes language acquisition in young children (Bruner, Goodnow & Austin, 1956; Galanter, 1966; McNeil, 1966, 1968; Miller & Chomsky, 1963; Miller, Galanter & Pribram, 1960).

A varied sample of proposals such as this serves to illustrate the increasing realization that studies of language and cognition are closely related, that consideration of the one is often illuminated by, if not contingent upon, consideration of the other, regardless of whether our primary interests lie in philosophical, psychological or linguistic inquiry.

The present dissertation intends to reflect this sort of interdisciplinary concern: while recent studies of linguistic development suggest that the individual can, from an early age, deal with the complexity of language, Piagetian studies of cognitive development suggest that the self-same individual is unable to handle apparently non-complex cognitive problems until considerably later in ontogenesis. More specifically, while studies of language acquisition suggest that the child can handle, with a fair measure of success, the complexities of morphology and syntax by age four years (e.g. Berko, 1958; Bellugi & Brown, 1964; Brown, 1965;

Smith & Miller, 1966), studies of cognitive development concerning the fundamental ability of classification suggest that the child is unable to handle the apparently simple problem of class inclusion before age eight years (Piaget, 1952, 1953; Inhelder & Piaget, 1964)¹. Such cognitive and linguistic phenomena in one and the same individual appear conceptually discomfiting, and this dissertation attempts to explore the possibility that in underestimating the role of language, studies of cognition may underestimate the individual's cognitive abilities.

That this may be so is suggested by the observation that Piaget's investigations of class inclusion have invariably employed language as a vehicle for study. As previous experiments have established, language can exert considerable influence on cognitive processes: the studies, for example, of Luria (1959) on the Pavlovian second signalling system, or Brown & Lenneberg (1954) on the Whorfian hypothesis, point to the influence which general features of the language code may have on cognitive processing, while the studies, for example, of Carmichael, Hogan & Walter (1932) on the effect of word-labelling on perceptual recall, or Judson, Cofer & Gelfand (1956) on the effect of paired-associate learning on problem-solving, indicate the possibility of influence on a more specific level. In addition, non-verbal studies of reasoning in children tend to confirm the view that in studies of cognition, the effects of language may be considerable (e.g. Braine, 1959, 1962)².

Yet despite this knowledge, little attempt has been made to consider the effect of linguistic variables associated with Piaget's

investigations of class inclusion. No doubt this is largely due to Piaget's disclaimer, detailed in the following chapter, of the relevance of linguistic abilities to the solution of this "cognitive" problem. Nevertheless, available evidence on the relations between language and cognition would appear to render suspect any inquiry into a cognitive problem via language, which fails to examine the possible influence of linguistic variables. It is this which motivates our inquiry, reported in the next three chapters, into the role of language in the problem of class inclusion.

Chapter 2

Class inclusion and language

Piaget's investigations of classification and class inclusion are reported at length in Piaget (1952), and in Inhelder & Piaget (1964); useful summaries appear in Beth & Piaget (1966), Donaldson (1960), Flavell (1963), Hunt (1961) and Piaget (1953); and a brief outline statement, which serves as a convenient starting point, is found in Piaget & Inhelder (1969)³:

When children from three to twelve are given a set of objects and instructed to "put things that are alike together," their sortings can be divided into three basic stages. The youngest subjects begin with "figural collections"; that is, they arrange the objects not only according to their individual similarities and differences, but also juxtapose

them spatially in rows, squares, circles, etc., so that the collection itself forms a figure in space. This figure serves as a perceptual or imagined expression of the "extension" of the class. The second stage is the stage of non-figural collections; the set is divided into small groups of elements each without any particular spatial form and these groups themselves can even be differentiated into subgroups. The classification now seems rational (after five and a half or six), but upon analysis it still betrays lacunae in "extension". If, for example, in a group B of twelve flowers within which there is a subgroup A of six primroses, you ask the child to show first the flowers B and next the primroses A, he responds correctly, because he can designate the whole B and the part A. However, if you ask him, "Are there more flowers or more primroses?" he is unable to respond according to the inclusion $A \subset B$, because if he thinks of the part A, the whole B ceases to be conserved as a unit, and the part A is henceforth comparable only to its complementary A'. He may reply, therefore, "the same", or, if there are a clear majority of primroses in the set, he may say that there are more primroses. The understanding of the relative sizes of an included class to the entire class is achieved at about eight and marks the achievement of a genuine operatory classification.

(Piaget & Inhelder, 1969: 102-103)

Thus Piaget isolates three main stages in the development of genuine classificatory behaviour, characterised by the arrangement of figural collections, non-figural collections, and the formation of genuine classes. As a genuine ability to classify is held to rest on the child's ability to negotiate the pons asinorum of class inclusion, attention is concentrated on this topic in what follows. But first the three stages in Piaget's account of the development of classification can be amplified.

Stage 1 : Figural collections

This stage appears at approximately ages two to five years. When the stage-1 child is asked to classify a set of presented objects (e.g. a set of variously coloured geometric shapes), sorting proceeds ((de proche en proche)): that is, although there is classificatory behaviour on the basis of similarity of attributes, this is often unstable and the sorting criteria tend to change as new objects are added to the collection, with the result that it loses the characteristics of a class (where all members are exhaustively classified under constant, common criteria), becoming what Piaget terms "a figural collection". For example:

FRA (4;0)⁴ arranges four blue and green rectangles to form a square enclosure, beneath which he makes a second enclosure out of five variously coloured squares. (The child) suddenly adds three circles underneath the rectangles and squares .. and says, "It's the Eiffel Tower".

(Inhelder & Piaget, 1964: 29)

This illustrates one facet of the child's inability to compose genuine classes: namely, the difficulty in distinguishing a logical class from an infralogical whole (i.e. a figural collection).

A further, equally important difficulty lies in the child's inability to co-ordinate class intension (the properties which permit class membership) and class extension (all objects exhibiting those properties). In genuine classification these must strictly correspond, but at this stage one observes lack of this necessary correspondence. In partitioning a set of square and non-square shapes for example, the child may begin to classify the squares in one pile, but either fail to include all squares, or else include non-squares.

Therefore before the child begins to classify in a mature fashion, it must distinguish logical from infralogical collections, and appreciate the necessity for correspondence between class intension and extension. Complete understanding of this intension-extension relationship (reflected in the grasp of terms like "some" and "all": see Inhelder & Piaget, 1964: Chapter 3) does not occur, according to Piaget, until the third stage of development, even although during the second stage it may appear from the child's behaviour (including verbal behaviour) that genuine classification is taking place.

Stage 2 : Non-figural collections

During this second stage of development, occurring from approximately five to seven years of age, non-figural collections replace the infralogical wholes of stage-1.

Here apparently mature classification may be observed for the child may now exhaustively classify objects on the basis of constant, common criteria; nevertheless, Piaget insists that the child's sorting behaviour results not in the formation of genuine classes, but rather in what are still, essentially, collections: thus crediting the child with mature classificatory behaviour is unwarranted, for it can be shown that the child still suffers from "lacunae in extension" of the sort illustrated above (p.6). This is what constitutes the problem of class inclusion, for it is the understanding of inclusion relationships that "marks the achievement of a genuine operatory classification" (Piaget & Inhelder, 1969: 103).

Stage 3 : Genuine classes

In the third and final (main) stage of development, occurring from approximately eight to eleven years of age, arrangement of non-figural collections is replaced by formation of genuine classes. In Piagetian terms, the child's thought has become "decentred", for now the child can not only construct heirarchical classifications, but in addition comprehend inclusion relations: it can now handle, simultaneously, the relations between any whole class and its constituent subclasses (provided, Piaget suggests, that the objects in question are concretely present). Thus the child's ability to classify concrete objects is now genuinely mature, and this ability may be said to have assumed the characteristics of concrete operational thought.

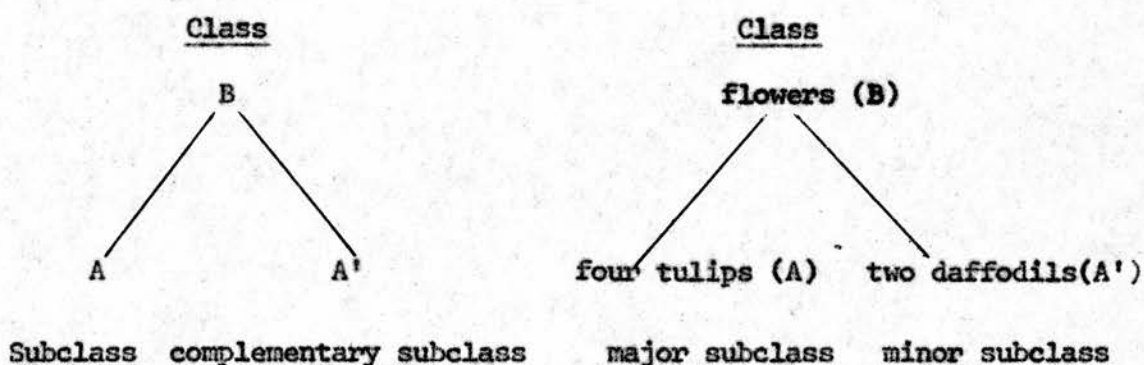
From this brief account, it can be seen that for Piaget, the crucial ability for the child to master before producing genuine

classification is the inclusion relation which obtains between class and subclass. As class inclusion clearly stands as foundation to genuine classification's edifice, this topic is now examined in some detail.

Class inclusion

Following Piaget, any class of objects is symbolised with B; a subclass of B with A; and the complementary subclass of A with A'. Consider for example a class of flowers (=B), composed of four tulips (=A), and two daffodils (=A') - see Figure 1.

Figure 1



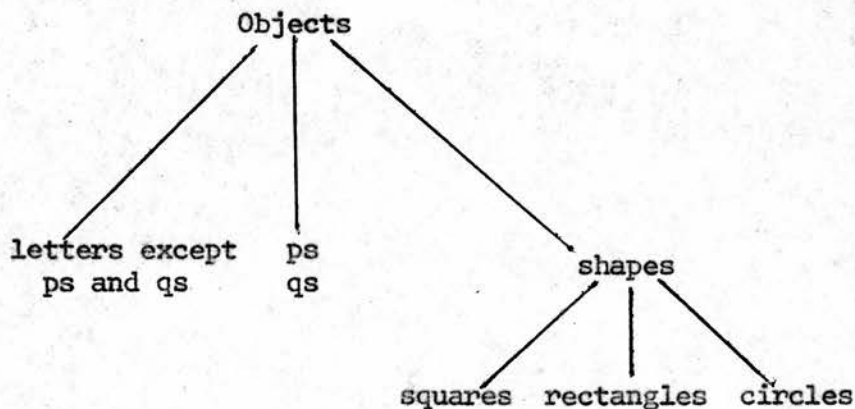
In this example the subclasses are unequal, and A will generally be used to denote the major subclass (the four tulips), and A' the minor subclass (the two daffodils). When the subclasses are equal (e.g. three tulips and three daffodils) this will be indicated.

As already noted, the stage-2 child is able to make the sort of heirarchical classification exhibited in Figure 1; indeed, it can set up more complicated classification heirarchies: when presented with geometric shapes (squares, circles, rectangles) and letters of the alphabet -

GIL (6;4) constructs three collections (see Figure 2):
 (i) all the letters except for p and q, (ii) all the ps and qs, (iii) geometric shapes. The last of these is divided so as to form three stacks containing squares, rectangles and circles respectively.

(Inhelder & Piaget, 1964: 54)

Figure 2



Thus the child appears to recognise that a class is composed of its subclasses, and may therefore be said to appreciate⁵ the relation $B = A + A'$. This will be referred to as the composition condition of classification, corresponding to the operation

of composition in set theory whereby two sets are combined to form a union of sets, this union being itself a set.

But what the stage-2 child cannot appreciate, according to Piaget, is the inclusion relationship holding between a class and its subclasses, which enables recognition that a subclass (A) is included in a class (B) while failing to exhaust it (e.g. tulips are flowers, but not all flowers are tulips). Thus the child may be said to fail to appreciate the relation $B - A' = A$, which will be referred to as the decomposition condition of classification, corresponding to the operation of decomposition in set theory whereby a set is partitioned to form constituent subsets:

In the case of true inclusion, B .. does not exist only when its constituent parts, $A + A'$, are actually united .. It continues to encompass them and it conserves its identity, even when these are dissociated. In other words, the subject is able to reason in the form $A = B - A'$. On the other hand, the essential characteristic of a collection as distinct from a class is that it exists by virtue of the union of its elements in space, and ceases to exist when its sub-collections are dissociated. It follows that, so long as the sub-collections are united in the form $A + A'$, the subject does connect them with the whole, $B(A + A' = B)$; but once they are dissociated, be it in space or even in thought, he no longer connects the sub-collections with the whole collection: in other words, the operation $A = B - A'$ is

beyond him. An operation being, by definition, reversible, we conclude that, since there is no inverse operation, $A = B - A'$, the union $A + A' = B$ cannot be a direct operation at stage-2, however much it may resemble one. It is in fact no more than an intuitive union because it is contingent upon a temporary differentiation of the collection B into the sub-collections A and A'.

Obviously it cannot always be easy to decide whether or not there is inclusion in this sense, simply by looking at the way in which a subject structures a varied set of objects into collections and sub-collections. It is quite possible to find one who constructs a fairly subtle hierarchy and is still unable to reason in the inverse direction, $A = B - A' \dots$

Present the child with a collection of items B, made up of two sub-collections, A and A', such that .. there are more A than A', and ask whether there are "more of A" or "more of B". Where there is no class-inclusion, children inevitably reply that there are more A than B, (i.e. the part is greater than the whole). The fact that A and A' are dissociated in imagination destroys the whole, B; and B is then reduced to A'.

(Inhelder & Piaget, 1964: 49-50)

The use of symbolism in Piaget's account is informative, for it implies
 | a further condition of genuine classification: namely that

these rules of composition and decomposition must be applicable to any domain of objects before the child can be credited with mature classificatory behaviour. That is to say, the rules must be "content-independent", their application not being restricted to any specific content area. What this involves is that the child must be able to apply these rules to the classification of animals as well as flowers, as well as geometric shapes, as well as coloured beads, as well as ...i.e. to any content area. Concern with the content-independence condition has been reflected in Piaget's research, where his experiments have involved various materials.

The early work on class inclusion (hereafter CI) arose in connection with studies of the child's conception of number (Piaget, 1952), where experiments were conducted with classes of flowers, beads, children, geometric shapes etc. Consider as an example the well-known experiment with beads, where Piaget used a box containing a set of twenty wooden beads, mostly coloured brown but with a few coloured white. This constituted:

B - the class of wooden beads

A - the majority subclass of brown beads

A' - the minority subclass of white beads.

When preoperational (e.g. Stage-2) subjects were presented with the inclusion question: "Does the box contain more brown beads or more wooden beads?" $(A(B))^6$, the characteristic response was "more brown beads" (A). A typical protocol (where the child's responses are underlined) reads as follows:

STRO(6;0): Are there more wooden beads or more brown beads in this box? - More brown ones. Why? - Because there are only two wooden ones. But aren't the brown ones made of wood? - Oh Yes! Well then, are there more brown ones or more wooden ones? - More brown ones.

(Piaget, 1952: 164).

Piaget interprets this result as showing:

The child between 5 and 7 years is unable to construct this inclusion $A \subset B$. His own interpretation of the facts leads him to conclude (and once again this demonstrates that the interpretation of perceptual data presupposes a previous logical elaboration) that $A \supset B$ because $A \supset A'$. His answer is: 'There are more brown beads (A) than wooden beads (B) because there are only two or three white ones (A')'. What this answer really means is: either the question deals with the whole class (B), and then all the beads are wooden ones, or it deals with a part (A); but if the whole is split up into its constituent parts we no longer have a whole. In this case it is reduced to the other part (A'), hence $A \supset B$ because $B = A'$. In other words, children find it difficult to reason about the whole and the parts at the same time. If they think of the whole, they forget the parts and vice versa. In order to construct the inclusion $A \subset B$, which, on the average, can be done between the ages of 7 and 8 years, the child has not simply to carry out a verbal or

symbolic translation of the perceptual data, but an operational composition or decomposition of its elements: $B = A + A'$, hence $A = B - A'$ and $A' = B - A$, hence $A < B$. The logical relationship is, consequently, much more than a linguistic expression which translates the empirical properties of objects. It is the resultant of the reversible actions of composition and decomposition, which consist of actual operations of grouping or regrouping carried out on objects.

(Piaget, 1953: 5-6)

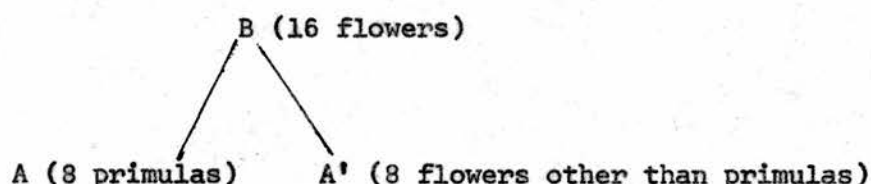
According to Piaget, while the child at this stage can handle the composition condition in an intuitive fashion (the brown beads are made of wood and the white beads are made of wood, hence the wooden beads comprise both the brown and white beads - i.e. $B = A + A'$), he is apparently unable to handle decomposition relations ($A = B - A'$ / $A' = B - A$).

However perhaps this is not quite accurate, for when two empty boxes were placed alongside the initial box, subjects were asked: "If we take out the brown beads and put them here (first empty box), will there be any beads left in this one (the full box)"; and, "If we take out the wooden beads and put them here (second empty box), will there be any left in this one (the full box)". Piaget reports that stage-2 subjects find no difficulty with these questions, the first being answered: "Yes, the white beads will be left", the second being answered: "No, there will be no beads left". These responses seem to suggest that the child can, to some extent, handle

the relations of composition and decomposition, for the former response implies that the wooden beads (B) minus the brown beads (A) leaves the white beads (A') - i.e. $B - A = A'$ (decomposition); and the latter response implies that removal of the wooden beads (B) involves removal of both the brown (A) and white (A') beads, leaving none in the box - i.e. $-B = -(A + A')$, or $B = A + A'$ (composition).

These paradoxical results also appear in Piaget's later work (Inhelder & Piaget, 1964: Chapter 4). Working with the classification hierarchy set out in Figure 3 (note that the subclasses are equal, thus $A = A'$), the following questions were presented:

Figure 3



Question

- (1) Are there more primulas or flowers (i.e. $A \text{ } B$)
- (2) If you take all the primulas, will there be any flowers left (i.e. $B - A = A'$)
- (3) If you take all the flowers, will there be any primulas left (i.e. $B = A + A'$)

Piaget reports (Inhelder & Piaget, 1964: 104) that the majority of stage-2 subjects (between 50 and 90 percent) answer questions (2) and (3) correctly, but fail with question (1). Illustrative

protocols quoted by Piaget are these:

THE (5;6) .. If you picked all the primulas in a field, would there be any flowers left - Yes. Now supposing you picked all the flowers would there be any primulas left? - Yes .. no. Why? - Because you're taking all the flowers.

AUB (6;9) (E takes two yellow primulas, one purple primula, and two other flowers): Are there more primulas or more flowers in this bunch? - More primulas, because here there are two (other flowers) and here there are three (primulas). And are there more yellow primulas or more primulas? - More yellow primulas. There is only one purple one.

DEM (6;6): Say you pick all the flowers in a field. Are there any primulas left? - No, I've picked them all. And if you take all the yellow primulas, will there be any primulas left? - Yes. If you take all the primulas, will there be any flowers left? - Yes, some daisies, a rose ...

(Inhelder & Piaget, 1964: 104,105)

Piaget's account of these data runs as follows:

In effect, the two statements: 1. "If one takes away all the primulas there will be no yellow primulas left", and 2. "If one takes away the yellow primulas, the purple ones will be left", should express the operations $A+A' = B$ and $B-A = A'$... Is this true of the child? To

prove that it is, one would have to show that B is retained in the child's mind, i.e. that the apparent logical subtraction really is the inverse of the apparent addition ... The only decisive test is to ask the subject to compare the extension of B with that of A. If he recognizes that there are more primulas (B) than yellow primulas (A) in a bunch, he must be aware of B as the sum of $A+A'$ and he must simultaneously be aware of A as the difference $B-A'$. Such simultaneous awareness, which is characteristic of operational thinking, implies the conservation of the whole B. It is not surprising that a subject at stage-2 can be intuitively aware that the whole is the union of its parts (statement 1), and that one part is distinct from another, even though he cannot compare the extensions of the part and the whole. For this comparison is not implied by statements 1 and 2. The fact that the subject only succeeds in comparing A and A' (for B is momentarily non-existent) shows that statement 2 does not express the logical subtraction of classes, but only a simple intuitive separation of A and A' .

When the problem of inclusion cannot be solved, the most frequent error is to compare A and A' , instead of A and B. But it is not the only one possible. The reduction of B to A' is not always automatic and unconscious; it may be motivated by the fact that one cannot use the same

elements in two different ways. A child, for example, may say: "If I make a bunch out of the primulas (A), the bunch of flowers (B) will no longer contain any primulas because these will be in the first bunch". (B is then reduced to A' by the conscious subtraction of A.) We might add that where there are more A's than As the subject often appears to be giving the right answer, although in fact when he tells us that there are more Bs than As, what he means is that there are more A's than As and he is simply calling the A's Bs.

(Inhelder & Piaget, 1964: 106,107)

Thus here we have an account of Piaget's criterion for successful classification. While the stage-2 child may be able to "intuitively" compose or "intuitively" separate B, A and A' as appropriate, he cannot be credited with genuine classificatory behaviour until he can be shown to treat such relations as operations of logical addition and logical subtraction; and further, he must be able to co-ordinate these operations simultaneously. This ability to simultaneously co-ordinate the operations of logical addition and subtraction is only uncovered with presentation of class inclusion questions, which require the subject to undertake simultaneous comparison of (the extensions of) the whole class with one of its parts. Of course besides Piaget's account of this "decisive test" of presenting class inclusion questions, a characterization of the processes which are held to underlie the erroneous responses of subjects at stage-2 is also provided:

namely, the child is unable to undertake simultaneous comparison (co-ordination) of part and whole; instead, it tends to compare the sub-parts.

Before coming to criticism of Piaget's account of class inclusion, it can first be remarked that there is independent evidence for the stability of the data. Various studies have observed that in children below about eight years of age, presentation of the inclusion question "A<B" invites the response "A" (e.g. Dodwell, 1962; Hyde, 1959; Inhelder, Bovet & Sinclair, 1967; Kofsky, 1966; Kohnstamm, 1963; Lovell, Mitchell & Everett, 1962; Morf, 1959; Wahlwill, 1968). Further, attempts to facilitate correct responses by various training procedures have proved generally unsuccessful (e.g. Morf, 1959), although the teaching of an explicit justification rule appears to have met with some, disputed, success (e.g. Kohnstamm, 1963, 1967; Pascual-Leone & Bovet, 1966). Thus for class inclusion questions, the data themselves appear stable, the child's responses entrenched.

However it is interesting to find that these independent studies have not attempted to examine other aspects of Piaget's data (e.g. are the data on "subtraction questions" stable? - see questions (2) and (3), p. 17 above). While confinement of attention to inclusion questions may be understandable in one sense (for the "decisive test" of the child's ability to classify is held to lie in the inclusion question: A<B), in another sense it is not. For perhaps the most striking aspect of Piaget's data lies in the anomalous results obtained with inclusion and subtraction questions. Consider the main results.

When presented with a class of material as depicted in Figure 1 above (six flowers: four tulips, two daffodils), and asked the inclusion question: (1) "Are there more flowers or more tulips", the child of below approximately eight years typically replies: "There are more tulips (A)". Thus the child is apparently unable to handle the problem of inclusion ($A \subset B$: i.e., $A + A' = B/A = B - A'/A' = B - A$). However, when presented with subtraction question (2): "If I take away all the tulips will there be any flowers left", and (3): "If I take away all the flowers will there be any tulips left", the child answers correctly; thus it does appear to appreciate the relations of composition ($B = A + A'$) and decomposition ($A = B - A' / A' = B - A$) just mentioned. Therefore in one context of questions (inclusion) the child appears unable to understand the relations between a class and its parts, while in another context of questions (subtraction) these relations seem correctly appreciated. Piaget's account of these results (which he himself describes as "paradoxical" - Inhelder & Piaget, 1964: 104) has already been encountered: we must, he suggests, distinguish between "intuitive" and "operational" composition and decomposition, and further insist on evidence of the co-ordination of these relations into an operational whole (pp.13, 19 above). Nevertheless, the apparent disparity between the child's performance in different contexts of questions constitutes a considerable anomaly when viewed apart from Piaget's theoretical terminology.

Consideration of a further aspect of the data uncovers an apparent inconsistency in Piaget's account. Here we refer to Piaget's characterisation of the processes underlying erroneous responses to class inclusion questions.

Two types of inclusion question can be distinguished: where the question involves inclusion of the major subclass A, we will talk of majority inclusion questions ($A \subset B$); and where the question involves inclusion of the minor subclass A', we will talk of minority inclusion questions ($A' \subset B$).

Again consider the material of Figure 1. When the child is asked the majority inclusion question ($A \subset B$): "Are there more flowers or more tulips", we obtain the response: "More tulips" (A). The reason for this, Piaget argues, is that since the child is unable to compare class B with subclass A, what in fact happens is that the child compares the two subclasses (A and A'). However, when the same child is presented with the minority inclusion question ($A' \subset B$): "Are there more flowers or more daffodils", we obtain the response: "More flowers" (B). Piaget suggests that this response is misleading, for it does not indicate that the child is handling the problem of inclusion correctly: rather, the child is still comparing subclasses A and A', but now he is "simply calling" the major subclass A by the class name B. Recall what Piaget has to say on this topic:

Where there are more As than A's the subject often appears to be giving the right answer, although in fact when he tells us that there are more Bs and A's, what he means is that there are more As than A's and he is simply calling the As Bs.^{7,8}

(Inhelder & Piaget, 1964: 106,107)

Thus the minority inclusion question invites the response: "More B",

not, according to Piaget, because of an ability to make a part-whole comparison: the child still compares the subclasses, and finding the major subclass the greater, he "simply" calls this major subclass A by the class name B.

Let this be tentatively accepted. The question now arises: why is there an inconsistency between this process underlying minority inclusion questions, and the process underlying majority inclusion questions? For when the majority inclusion question ($A \subset B$): "Are there more flowers or more tulips" is presented, we now obtain the response: "More tulips" (A). As before, Piaget suggests that the child compares the subclasses, finding the major subclass to be the greater. But whereas with minority inclusion questions the child "simply called" major subclass A by class name B, clearly this fails to occur with majority inclusion questions.

Thus there appears to be an element of inconsistency in Piaget's account of the two types of inclusion question: while the basic process underlying both is held to be similar (reduction to subclass-subclass comparison), a further process which is held to underlie one type ("simply calling" A "B" in minority inclusion questions) is clearly absent in the other type (absence of "simply calling" A "B" in majority inclusion questions).

However apart from the anomaly between results obtained in different contexts of question (inclusion and subtraction), and the inconsistency in processes held to underlie different types of inclusion question (minority and majority), there is a further, perhaps more general feature of Piaget's position which is considerably

perplexing. Here we refer to Piaget's views on the relevance of language to class inclusion.

Class inclusion and language

Piaget is quite explicit on this topic:

Both the syntax and the semantics of language involve structures of classification and seriation. That this is true of classification is immediately obvious. All nouns and adjectives divide reality into classes. Insofar as children use words with the same meaning as adults, these may be directly transmitted to them when they learn to talk. In any case, words inevitably force a beginning of classification on the child.... One possible hypothesis would be to attribute the formation of classification and seriation exclusively to language. Alternatively, we could give language no more than an auxiliary role (e.g. that of an accelerator). We might even say that while language is necessary for the completion of these structures, it is insufficient for their formation. If this view were found correct, their formation would have to be explained by operational mechanisms which underlie linguistic activity but are themselves independent of their verbal expression.

(Inhelder & Piaget, 1964: 2)

From the beginning language favours a series of assimilations, and these imply a notion of similarity. (In the same way, unsuccessful attempts at assimilation create a notion of dissimilarity.) But for a long time these relationships cannot be made concrete and precise. Little children cannot arrange a set of objects in such a way as to bring out the relation of inclusion, which is a part-whole relation. Yet this relation is essential to an understanding of classification in the strict sense. We are bound to conclude that, although language is an important factor in building logical structures, it is not the essential factor.

(Inhelder & Piaget, 1964: 4)

Thus while recognising the general importance of language, in relation to the specific topic of classification Piaget characterises language as serving a subsidiary role: although language may serve as an accelerator, little importance is attached to the possibility of a radical, fundamental relation between the child's linguistic and cognitive abilities in classification tasks.

Viewed simply as an a priori assertion, Piaget's position is clearly unsatisfactory; however, he adduces evidence in support of his position:

It is legitimate to conclude that the schema of class-inclusion is a genuine logical operation and not a question of mere verbal facility. A number of writers found that children of 2-4 would tell them that a dog was an animal,

a lady was a person and a daisy was a flower. They concluded that these children had reached the level of hierarchical classification. To this we cannot agree. What these facts indicate is that, given certain familiar elements, these tiny children can reach beyond the level of graphic collections, and the corresponding linguistic schemata are structured into parts and wholes. But the structure is not that of an operational classification. It is that of a non-graphic collection, which is perfectly consistent with the degree of differentiation shown. The present results indicate that it is one thing to carry out the union expressed by $A+A' = B$ and quite another to understand that it is logically equivalent to its inverse $A \subseteq B-A'$, which means that the whole, B, retains its identity and that the entire relation can be quantitatively expressed in the form $A \subseteq B$. The conservation of the whole and the quantitative comparison of whole and part are the two essential characteristics of genuine class-inclusion ... Inclusion has not been acquired merely because the child talks correctly and uses verbal concepts which reflect the inclusions implicit in the language of adults.

(Inhelder & Piaget, 1964: 117)

It is not enough to study the way in which intension and extension are as it were pre-figured for the child in the system of verbal concepts which is incorporated in common language. As a matter of fact, the results of our

investigations .. on the quantification of inclusion show very clearly that children only reach a proper understanding of the extension of verbal concepts .. in the measure that they can themselves re-structure the content. In other words, the starting-point for the understanding, even of verbal concepts, is still the actions and operations of the subject.

(Inhelder & Piaget, 1964: 283-284)

Thus despite knowledge of the lexical aspects of class inclusion problems from about four years of age (e.g. that both men and women are people), the child persists in making errors with inclusion problems until about eight years of age (e.g. the child will say that there are "more women than people" in a situation where there are five women and three men, all of which, the child has already agreed, are people).

There would therefore appear to be some grounds for denying a radical relationship between linguistic and classificatory abilities, for the child can apparently handle the lexical aspects of class inclusion (- the "decisive test" of genuine classificatory behaviour) long before it can handle the cognitive aspects of the problem.' '

However Piaget seems open to criticism here, for while denying the relevance of language to class inclusion, he has invariably employed language as a vehicle for study. In the absence of variation of appropriate linguistic parameters, Piaget's position on the non-linguistic nature of the problem of class inclusion seems best viewed

as a hypothesis.

Of course this line of argument is by no means novel:

(In Piagetian studies) the problem of task-vocabulary is at least partly a straightforward empirical problem: one can vary the verbal aspects of the task and observe any resultant variation in the child's response level. But there is another verbalization-relevant problem not so readily managed. The child not only responds to verbalization in Piaget's tests, he also responds with verbalizations, and the problem lies in trying to decipher these for their cognitive-developmental meanings and implications. Piaget has not been unaware of this problem of translation and has, in fact, discussed it in considerable detail (e.g. Piaget, 1929). He has not, however, always followed his own stated precautions regarding it, and has frequently made cognitive inferences from verbal protocols as though there were no translation problem at all.

We have argued that the child's linguistic comprehension and usage is not independent of underlying intellectual structure and orientation, but it would be absurd to suppose that the one is always going to provide a faithful and accurate image of the other. One must always look to the possibility, particularly in studies like Piaget's, that what the child says will lead you either to an overestimation or an underestimation of his operant intellectual level ... The translation problem has been and will long continue to be

one of the most troublesome for developmental studies of the Piagetian type. Indeed, much of the criticism of Piaget, especially the early Piaget, comes down to a dissatisfaction with his language-thought translations.

(Flavell, 1963: 437)

Other writers have made the same point:

Piaget is inclined to see through words as though they were not there and to imagine that he directly studies the child's mind.

(Berko & Brown, 1960: 536)

However this sort of criticism provokes an immediate difficulty: while there certainly appears to be sufficient justification for examining the role of language in studies of cognition, there seems no way of deciding, a priori, precisely which linguistic parameters to vary. While we may agree with Flavell's remark that: "One can vary the verbal aspects of the task and observe any resultant variation in the child's response level", we are nevertheless bound to ask: "How do we decide which verbal aspects to examine?"

This problem does not appear to have received a great deal of attention; in fact, the problem has often been circumvented by undertaking "non-verbal" studies of cognition (e.g. Braine, 1959, 1962) where the conclusion: that language influences cognition, however interesting and informative, nevertheless leaves the problem intact; such a conclusion in no way illuminates which

aspects of language influence cognition, nor the nature of such influence. Given the assumption that language does influence cognition (an assumption for which, as suggested in Chapter 1 above, there is considerable empirical support), it is of course to just these topics that maximum interest attaches.

In the absence of an established literature on which aspects of language might be appropriately manipulated in Piagetian studies such as class inclusion, we approach this problem indirectly by turning to consideration of studies in the psychology of language where a number of aspects of language have been subject to some previous inquiry.

Chapter 3

Studies of language

It was suggested in Chapter 1 that during the present century, the scope of study in language and cognition shows considerable variation, ranging from concern ^{with relations} between cognition and general features of the language code (the work of Vygotsky, Luria, Whorf, etc.), to more limited concern with relations between cognition and specific aspects of language (the studies of Carmichael et al., Judson et al. etc.). In recent years however, a great deal of attention has been devoted in psychology to consideration of language itself, and especially to consideration of language structure (syntax).

Initially, experiments in psycholinguistics seemed to hold great

promise. Working within a framework of generative transformational grammar proposed by Chomsky (1957), natural language users (i.e. experimental subjects) were observed to require more time to process sentences that were complex in terms of linguistic structure, over sentences that possessed a simpler structural form (e.g. Miller, 1962). The conception underlying these early studies was that while sentences may vary in surface form they nevertheless derive via application of various transformation rules to a common underlying base. According to this conception, sentences (2) through (7) are characterised as deriving from a common base, the differences between their derived surface forms being accommodated by application of passive (P), negative (N), interrogative (Q), passive negative (PN), passive interrogative (PQ), and negative interrogative (NQ) transformations respectively. (Let (1), a simple active declarative sentence which has had no optional transformation applied to the underlying string, be described as a kernal sentence (K) - see Chomsky, 1957):

- | | |
|------------------------------------|------|
| (1) the boy hit the ball | (K) |
| (2) the ball was hit by the boy | (P) |
| (3) the boy didn't hit the ball | (N) |
| (4) did the boy hit the ball? | (Q) |
| (5) the ball wasn't hit by the boy | (PN) |
| (6) was the ball hit by the boy? | (PQ) |
| (7) didn't the boy hit the ball? | (NQ) |

So for example, it was found that in a sentence-matching task, the

greater the number of transformations applied to the underlying base, the longer the processing latencies (Miller, 1962). Further experiments appeared to confirm that transformed sentences were more difficult to handle than kernal, lending support, both to the notion that there was some "psychological reality" to transformational grammar, and in turn, to further psychological studies of syntax (e.g. Epstein, 1961, 1962; Gough, 1965; Marks & Miller, 1964; McMahon, 1963; Mehler, 1963; Miller & Isard, 1963; Miller & McKean, 1964; Savin & Perchonock, 1965; Slobin, 1963).

However the data of these studies contained certain anomalies, and it soon became apparent that no satisfactory explanation of language processing was to be found solely in terms of linguistic structure. For illustration, consider Mehler's early model for the storage and recall of transformed sentences, which envisaged the storing of kernal or base strings, plus "tags" indicating the nature of the transformation(s) to be applied. On this view, (8) would be stored as (9):

(8) the door is not open

(9) kernal (the door is open) + tag (negative
transformation)

Should there be impairment in subsequent recall, the more likely element to be lost would be the tag rather than the kernal, leading to the impaired recall of (9) as (10):

(10) the door is open

Clearly, (10) involves a change in meaning from (8). But in a study

of memory for gist, Fillenbaum (1966) observed that such "meaning-changing" errors were less likely to occur than "meaning-preserving" errors: that is, if there was impairment in the recall of a sentence like (8), impaired recall was more likely to be like (11) which preserves the meaning of the original sentence:

(11) the door is closed

Therefore it can be appreciated that when we consider questions of meaning, the early studies on linguistic structure are by no means free from criticism.

Of course to be fair, this was explicitly recognised in the early studies themselves - whereas Miller (1962) had found that passive sentences took longer to match than did negative sentences, McMahon (1963) argued that Miller's task had involved no concern with meaning, and when a different task was employed, the opposite result was observed - negatives took longer to process than passives. Since, transformationally, passives are more complex than negatives, and since errors were observed to cluster on negatives rather than on sentences that were grammatically more complex, McMahon was led to suggest that negatives involved considerable semantic complexity.

Questions relating to semantics were also raised in connection with passives. When it was suggested that actives and passives with the same underlying phrase markers were mutually paraphrastic, this was interpreted by some as a claim that actives and passives were generally synonymous, the resultant confusion being attributed to a failure to distinguish syntactic and semantic claims - e.g.: Chomsky, 1965; Katz & Martin, 1967; Katz & Postal, 1964; Ziff, 1966.

However while considerable attention has been devoted towards study of syntactic and semantic aspects of language, a more recent trend has been towards study of the communicative function of linguistic structures. Given the sort of conception engendered by transformational grammar, this is perhaps understandable: consider passive constructions. If such structures involve the application of transformation rules to a base string which exhibits the underlying logical relationships holding amongst the components of any derived sentence, then we might ask why passive constructions ever appear in the language at all, for they "seem at first glance to have no purpose" (Wales & Marshall, 1966: 77). For compare (12) and (13):

(12) John hit Mary

(13) Mary was hit by John

Both derive from an underlying base which exhibits the logical relationships holding between John and Mary: namely, John is the logical subject, Mary is the logical object, etc. Now if these relationships can be expressed in active sentences like (12), why is there a need in the language for the further complication of passive constructions like (13)? This sort of consideration, in no way alleviated by those early psychological studies which found that (English) passives required more processing time than actives (Miller, 1962; McMahon, 1963; Slobin, 1963¹⁰), has turned attention towards asking how structures such as the passive function in language use.

Following Chomsky's misgivings that actives and passives generally exhibit synonymy - e.g. compare (14) and (15) which Chomsky (1965) reports as apparently non-synonymous:

(14) Everyone in the room speaks at least
two languages

(15) At least two languages are spoken by
everyone in the room

- one proposal on the communicative function of the passive runs to the effect that such constructions may serve a disambiguating function in certain contexts of use. Thus in a situation where John killed the father of Tom, we might prefer (17) to (16):

(16) John killed his father

(17) His father was killed by John

: for (16) may encourage interpretation of his as a pronominalization for John, leading to the incorrect interpretation that John killed his own father, rather than the father of some male other than John (in this case: Tom) (Chomsky, 1965).

Psychological studies have attempted to clarify the communicative function of the passive in more general terms. For example, Johnson-Laird presents evidence from tests of speakers' comprehension and production that:

The passive implies that the logical object is more important than the logical subject whereas the active implies that there is a minimal difference in the importance of these two entities or that the logical

subject slightly predominates.

(Johnson-Laird, 1968: 7)

Consider:

(18) the man was killed by the woman

(19) the woman killed the man

(18) implies that it is the man (logical object) who is important, whereas (19) implies that there is little difference between the importance of the two or that the woman (logical subject) is slightly more important.

(Johnson-Laird, 1968: 7)

Johnson-Laird is frank in noting that the notion of "importance" is vague, and his study concentrates on "emphasis": "the passive is more emphatic than the active", and "it is word order that indicates to what the emphasis is being given" (Johnson-Laird, 1968: 13,14).

Data from other studies appear consistent with this account: for example, when subjects are asked to complete active and passive sentence-frames, they: "put what they want to talk about ... in the beginning of the sentence" (Clark, 1965: 369)¹¹; in studies with children, the voice in which sentences are remembered is found to be a function of differential focus of attention on the actor or acted-upon element at times of sentence storage and, especially, sentence retrieval (Turner & Rommetveit, 1968); and, subjects are found to prefer the use of active sentences in the description of situations where a "conceptual focus" is placed on the actor-subject,

but prefer passives when the focus is placed on the acted-upon-object, "conceptual focus" being induced by use of a preamble (provision of a context) that emphasizes either the subject or object (Tannenbaum & Williams, 1968).

Consideration of this account, against a situation where John struck Mary, therefore provides the following notions: recall sentences (12) and (13) above:

(12) John hit Mary

(13) Mary was hit by John

Were John the "important entity" in this situation, (12) might be preferred to (13) as a description; however, were Mary the "important entity", (13) might be preferred to (12), for use of the passive indicates that "to what the emphasis is being given" has switched from John, the logical subject, to Mary, the logical object. Thus this account of passive constructions, in terms of voice and word order, holds that use of the passive indicates that "importance" attaches to that entity which occupies initial, rather than subsequent, nominal position in the sentence, thereby serving a useful communicative function.

Clearly, these notions hold considerable interest for the purposes of this dissertation, for as already mentioned, a notable verbal aspect of Piagetian tasks is concerned with interpretation of adult utterances by the child and of child utterances by the adult (i.e. experimenter) - in short, with communication in discourse (see p.29 above). Now if certain communicative functions are served by variation in the syntactic structure of utterances

employed in language use (discourse), this might suggest that we manipulate syntactic variables in the "verbal aspects" of class inclusion tasks in an attempt to uncover possible communicative misunderstandings which might obtain between adult and child.

Thus we might manipulate specific syntactic variables such as question form (e.g. "Are there more A or more B?" versus "Are there more A than B?"), question term order (e.g. "Are there more A or more B?" versus "Are there more B or more A?", etc.), or suprasegmental features such as stress (e.g. "Are there more A or more B?" versus "Are there more A or more B?" versus "are there more A or more B?", etc. where primary stress is indicated as falling on underlined terms), or intonation (e.g. "Are there more A or more B?" mapped on to intonation patterns like:

- (i) $\overline{A} \setminus B \setminus$ (Are there more A (drop) or more B (drop))
- (ii) $\overline{A} / B \setminus$ (Are there more A (rise) or more B (drop))
- (iii) $\overline{A} \setminus B$ (Are there more A or more B (drop)), etc.¹²

However before engaging in an examination of such specific syntactic variables, we are first bound to query its general viability: namely, is there sufficient support for the conclusion that communicative functions are served by variation in the syntactic form of utterances produced in discourse? In the experiments which now follow, this general notion is examined in some detail with respect to utterances of different syntactic form: namely, active and passive constructions.

First recall the essentials of the voice-word order account (VWO)

of passive constructions indicated above. When the logical object is "more important" than the logical subject, this is indicated by employment of a passive structure which ensures that the logical object occupies initial rather than subsequent nominal position in the sentence. Thus use of the passive emphasizes that the logical object is the important entity. Now consider some difficulties.

First: by denying recourse to the proper names of (12) and (13), we immediately find ourselves involved with definiteness as in (20) and (21):

(20) the boy hit the girl

(21) the girl was hit by the boy

The contention of VWO, that the important entity is indicated by initial nominal position in passives, seems only now maintained by adoption of an assumption of the irrelevance of definiteness. It seems that all previous studies have made this assumption, all strings used as experimental material having had both nominals definitely marked. It will be suggested below that the validity of this assumption is open to question.

Second: most previous psychological studies have used "full" passives like (22) as compared with "short", "agentless", or "impersonal" passives like (23):

(22) John was killed by Bill

(23) John was killed

: a factor which appears to create difficulties for VWO, for:

It is...a commonplace of traditional syntactic theory that the principal function of the passive in all languages

(and in some languages its only function - e.g. Turkish) is to make possible the construction of "agentless" or "impersonal" sentences.

(Lyons, 1966: 130)

While Lyons notes that in English the agentive adjunct occurs quite freely (which is unusual in comparison with other languages), it is yet the case that short passives occur more frequently than full passives (Lyons, 1968: 378; Jespersen, 1924; Svartvik, 1966). But if short passives are more common in English than full passives, to what extent are generalisations about the function of passives marred by exclusive use in experiments of relatively less frequent full constructions? And perhaps more to the point, does an account that holds the passive to emphasize the importance of the nominal that occupies first rather than subsequent nominal-position in the sentence not lose some of its appeal with the observation that the most frequent type of passive occurring in the language fails to specify any nominal other than the initial one?

The following two experiments attempt to test the force of these difficulties. Specifically, employing active and full passive constructions, the assumption that definiteness is irrelevant to determination of "important" nominals is questioned in Experiment 1 by testing conflicting predictions that arise: (i) from VWO, and (ii): from an alternative account based on a topic-comment distinction (see below). Finding the latter account the more satisfactory, its tenability for both full and short passive constructions is then examined in Experiment 2.

First consider a distinction between topic and comment¹³.

For speaker-hearer exchanges (discourse), topic may be defined as the person, object or event about which something is said, and comment as the information conveyed about this person, object or event (cf: Lyons, 1968: 335). Thus the notion of topic parallels "subject of discourse" (Sapir, 1921), "centre of interest" (Jespersen, 1924), "what we want the hearer to attend to specially" (Frege, 1879), "important entity" (Johnson-Laird, 1968), and "conceptual focus" (Tannenbaum & Williams, 1968).. It may also be supposed that in a speaker-hearer exchange, the speaker presupposes that the hearer has knowledge as to topic and ignorance concerning comment, for when these presuppositions are not met, communication fails in the former case and is redundant in the latter. (We return to this below).

It can further be assumed that in strings with two differentially determined nominals (a N + V + the N; the N + V + a N) (where N = noun and V = verb), topic is indicated by that nominal which is definitely marked - i.e. topic-indication is provided by definiteness. For example, in (24) and (25) it is assumed that topic is "boy", whereas in (26) and (27) topic is "girl":

- (24) the boy hit a girl
- (25) a girl was hit by the boy
- (26) a boy hit the girl
- (27) the girl was hit by a boy

This assumption arises since definitely marked nominals seem to require presupposition of previous knowledge: use of the "tacitly

insinuates a kind of previous acquaintance by referring the present Perception to a like Perception already past" (Harris, 1751: 213; cf: Sapir, 1921: 90). Of course this view of Harris is no more than an intuition, but its validity can be established empirically - see Experiments 3 and 4 below.

From this brief sketch of the topic-comment distinction, it is clear that this topic-comment account (TC) conflicts with VWO. First consider sentences where the nominals are differentially determined (e.g. (24) through (27) above). VWO makes firm predictions for passive constructions (25) and (27) whereby the "important entities" are the logical objects (- i.e. the nominals occupying initial position in these passives), and weak predictions for active constructions (24) and (26) whose important entities are identified as the logical subjects (- again, the initial nominals). However TC predicts that the important entities of these constructions are those nominals which are definitely marked: as already mentioned, "boy" in (24) and (25), "girl" in (26) and (27).

Now consider sentences where both nominals are definitely marked:

(28) the boy hit the girl

(29) the girl was hit by the boy

The important entities predicted by VWO are again the initial nominals, especially for passive construction (29). Since TC suggests that the speaker of (28) and (29) has presupposed in his listener previous knowledge of both (definitely marked) nominals, TC can offer no predictions as to the important entities of such sentences.

However with sentences where neither nominal is definitely marked:

(30) a boy hit a girl

(31) a girl was hit by a boy

:while VWO will again predict the initial nominals, especially in passive construction (31), TC suggests that the important entity is the event, rather than the persons involved: namely, the action of striking, for knowledge in the listener of neither nominal has been presupposed (definitely marked) in their putative production.

Thus the VWO and TC accounts of active and passive constructions differ in a number of respects, and their conflicting predictions as to the important entities of constructions like (24) through (31) are summarized in Table 1.

Table 1/

Table 1: Predictions of VWO and TC for the eight sentence types of
Experiment 1

Sentence type	Characteristics*	Example	Predictions**	
			<u>VWO</u>	<u>TC</u>
1	<u>the</u> N1 + V(act) + <u>the</u> N2	the boy hit the girl	(N1)	no prediction
2	<u>the</u> N1 + V(act) + <u>a</u> N2	the boy hit a girl	(N1)	N1
3	<u>a</u> N1 + V(act) + <u>the</u> N2	a boy hit the girl	(N1)	N2
4	<u>a</u> N1 + V(act) + <u>a</u> N2	a boy hit a girl	(N1)	E
5	<u>the</u> N1 + V(pass) + <u>the</u> N2	the girl was hit by the boy	N1	no prediction
6	<u>the</u> N1 + V(pass) + <u>a</u> N2	the girl was hit by a boy	N1	N1
7	<u>a</u> N1 + V(pass) + <u>the</u> N2	a girl was hit by the boy	N1	N2
8	<u>a</u> N1 + V(pass) + <u>a</u> N2	a girl was hit by a boy	N1	E

*N1 = nominal occupying initial sentential position

N2 = nominal occupying subsequent sentential position

(act) = active

(pass) = passive

** (N1) = weak prediction for N1

N1 = strong prediction for N1

Etc.

E = event

We now turn to some data which attempt to distinguish these accounts.

Experiment 1

Subjects 40 naturally English speaking undergraduates of mean age 21 years (range: 18-25); approximately half were male.

Material Eight situations were described with active and passive forms of description, each form containing two nominals. The four possible combinations of determiners (the-the, the-a, a-the, a-a) were then mapped on to the nominals of these descriptive forms. Four of the eight situations were "reversible" (R) - e.g. boy hit girl, and four were "non-reversible" (NR) - e.g. boy broke window; reversing the nominals in the latter string yields *window broke boy, whereas reversal of nominals in the former type of string is acceptable (see Note 10). The eight situations described were these:

(R) taxi bumped lorry	(NR) porter hailed taxi
car overtook bus	artdealer bought fake
boy hit girl	boy broke window
woman saw man	woman smoked cigarette ¹⁴

This procedure yielded 32R and 32NR sentences; these were typed out on separate lists. For both lists, each successive block of eight sentences included an example of each sentence-type (see Table 1), order of presentation within each block being randomly arranged. As completion of the first block of sentences simply exposes subjects to all sentence-types, performance on these items will be regarded as practice, and data from the remaining 24 items (8 sentence-types x 3 examples of each type) reported below.

Procedure A considerable difficulty in this area lies in getting subjects to respond without selling the pass in experimental instructions: we wish subjects to indicate the important entity of each sentence, and the problem lies in providing subjects with an instruction which will both prevent individual variation in interpretation of instructions on the one hand, and discourage any particular response bias on the other. Pilot testing underlined the importance of this point, for it was found that mode of instruction could exert considerable influence on mode of response. The most satisfactory procedure to emerge consisted in instructing subjects to regard each sentence as an answer to a question, and making it their task to supply the question. Thus when given a sentence (e.g. "Today is Tuesday") subjects had to regard this as an answer, and construct a question for this answer (e.g. "What day is it?"). This procedure enjoys a number of benefits, for, in constructing a question for each sentence, the subject is obliged to indicate the important entity¹⁵, and the method provides a precise instruction: to construct a question, without creating any response bias: the characteristics of the questions to be constructed by the subject are never alluded to. As the pilot studies also indicated the possibility of interaction effects when both R and NR sentences appeared in the same list, half of the group of forty subjects was presented with R lists, and the other half with NR lists.

Results Classification of responses is as follows: where one nominal, or its pronominal, has been mentioned in the question-

response, then the position of this nominal in the original sentence-as-answer has been recorded (i.e. N1 or N2; see examples (a) and (b) below); where neither nominal (pronominal) has been mentioned in the question-response, this has been recorded as "E" (= event; see example (c)); and where both nominals (pronominals) have been mentioned, this has been recorded as "O" (= unclassified; see example (d)). Since this lattermost type of response effectively repeats the stimulus sentence, minimally altered to interrogative form, it cannot be assigned to the N1, N2 or E category without appeal to intuition, and here we prefer to leave such responses "unclassified".

For example, for the presented sentence the boy hit the girl, four typical responses (a) through (d) have been classified as follows:

<u>Sentence-as-answer</u>	<u>Question response</u>	<u>Classification</u>
<u>the boy hit the girl</u>	(a) What did the boy do?	N1
	(b) What happened to the girl?	N2
	(c) What happened?	E
	(d) Did the boy hit the girl?	O

Data appear in Table 2, where entries represent the number of subjects who made consistent options for response categories N1, E or N2. "Consistent" is defined as choice of any response category twice or thrice out of three choices (- each subject responds to three examples of each sentence type: see p. 47 above).

Table 2 : Consistent response options by sentence type (Experiment 1)

Sentence type	Response categories			Totals
	<u>N1</u>	<u>E</u>	<u>N2</u>	
1	5	5	21	31
2	29	5	6	40
3	1	4	34	39
4	0	29	8	37
5	30	6	0	36
6	36	4	0	40
7	8	5	25	38
8	5	32	1	38

For each sentence-type there is a possible maximum of 40 subjects who respond consistently for the three response categories; departures from this maximum arise where subjects responded once in each category for the same sentence-type (i.e. absence of consistency), and/or where subjects consistently responded with "unclassified" responses (i.e. category 0) which effectively repeat the stimulus sentence, providing no indication of the important entity. Clearly, both inconsistent and unclassified responses do not permit distinction between VWO and TC; analysis is therefore concentrated on the remaining data which do permit distinctions to be made.

Testing observed responses against chance distributions for each sentence-type, we find where significant options have occurred for one of the three response categories; these are presented in

Table 3 where the predictions of VWO and TC are summarized for comparison with observed results.

Table 3: Significant options for response categories N1, E or N2
(Experiment 1)

Sentence type	Options predicted		Options observed*
	<u>VWO</u>	<u>TC</u>	
1	(N1)	no prediction	N2 (χ^2 : 11.02)
2	(N1)	N1	N1 (χ^2 : 18.42)
3	(N1)	N2	N2 (χ^2 : 33.92)
4	(N1)	E	E (χ^2 : 22.54)
5	N1	no prediction	N1 (χ^2 : 27.00)
6	N1	N1	N1 (χ^2 : 38.55)
7	N1	N2	N2 (χ^2 : 12.00)
8	N1	E	E (χ^2 : 29.49)

*All observed values of χ^2 are significant beyond the .001 level.

Clearly data provide a closer fit with the predictions of TC than with the predictions of VWO. Thus indication of the "important entity" of a sentence is not simply provided by voice and word-order, for in full constructions containing two nominals, subjects indicate as important - regardless of voice - that nominal which is definitely marked when the nominals are differentially determined (i.e. N1 in sentence-types 2 and 6; N2 in types 3 and 7), and the event when neither nominal is definitely marked (i.e. E in types 4 and 8).



(Where both nominals are definitely marked in types 1 and 5, it has been noted that VWO makes a weak prediction of N1 for type 1 (active) and a strong prediction of N1 for type 5 (passive); TC offers no prediction for either type. In Table 3 it can be seen that significant options have been observed: N1 for type 5 as VWO predicts, but surprisingly perhaps, N2 for type 1. While the former result on type 5 is taken into consideration below, the somewhat surprising result on type 1 need not detain us since there are such marked differences between the characteristics of the response data for this particular sentence-type compared with data characteristics of the other seven sentence-types.¹⁶)

Discussion The results of Experiment 1 suggest the untenability of VWO's implicit assumption that definiteness is irrelevant to consideration of full passive constructions containing two nominals, and lend some support to an alternative (TC) account. However while these results are of some interest, it has already been mentioned that the adequacy of any account of the passive is not to be measured in terms of its ability to accommodate full passive constructions, but rather in terms of its ability to accommodate both full and short passives, the latter sort of construction being the more typical of the language. Therefore the next step is clearly to test the predictions of TC with respect to both full and short passives.

Experiment 2

Subjects 112 naturally English speaking undergraduates (approximately half were male) of mean age 22 years (range: 18-29) were assigned at random to seven groups (n = 16) described below.

Material Since we wish to compare options for topic in short and full passives containing definitely and nondefinitely marked nominals occupying patient¹⁷ and, in full constructions, agent position, six types of sentence were constructed from the template shown in Table 4 where P = patient nominal, A = agent nominal, ØA = unspecified agent nominal, D = definitely marked nominal, ND = nondefinitely marked nominal. The reversible and nonreversible sentences employed are mapped out in full.

Table 4: /

Table 4: Template for construction of material (Experiment 2)

Sentence type	Characteristics	Examples
(a)	NDP : \emptyset A	A man was killed A toy was stolen
(b)	DP : \emptyset A	The man) was killed John) He) The toy) was stolen It)
(c)	NDP : NDA	A man was killed by a woman A toy was stolen by a boy
(d)	DP : NDA	The man) was killed by a woman John) He) The toy) was stolen by a boy It)
(e)	NDP: DA	A man was killed by (the woman (Mary (her A toy was stolen by (the boy (Tom (him
(f)	DP : DA	The man) was killed by (the woman John) (Mary He) (her The toy) was stolen by (the boy It) (Tom (him

The results of Experiment 1 suggest that for full constructions, sentence topic is related to definiteness regardless of voice and word-order; predictions for the full passives of the present experiment are therefore as before: the important entities of sentence-types (c),

(d), and (e) are, respectively, predicted as E (the event, for neither nominal is definitely marked), N1 (the definitely marked patient nominal which appears with a nondefinitely marked agent), and N2 (the definitely marked agent nominal which appears with a nondefinitely marked patient). TC again offers no predictions for the full passives of sentence-type (f) where both nominals are definitely marked.

As regards the short, "agentless" constructions of sentence-types (a) and (b), the options predicted by TC are the event E in type (a) where the patient nominal is not marked for definiteness, and N1 in type (b) where the patient nominal is definitely marked.

Procedure The sentences were typed out on separate pages which were then stapled into booklets showing one sentence per page. For any group, the short passives always appeared on the first booklet page before any of the full constructions whose within-group orders of presentation sampled the 24 possible orders (4!). Sentences assigned to each group are shown in Table 5.

Table 5: Sentences assigned to groups (Experiment 2)

Group	Sentences
1	(NDP) A man was killed)by <u>ØA</u> by a woman by the woman by Mary by her
2	(DP) The man was killed)(<u>ØA</u>) (NDA) (DA) (DA) (DA)
3	(DP) John was killed)
4	(DP) He was killed)
5	(NDP) A toy was stolen)by <u>Ø</u> by a boy by the boy by Tom by him
6	(DP) The toy was stolen)(<u>ØA</u>) (NDA) (DA) (DA) (DA)
7	(DP) It was stolen)

For any sentence, subjects were required to construct a question to which the sentence could serve as answer (as in Experiment 1). Subjects were further instructed not to read through their booklets before beginning, nor, after beginning, to turn back to previous pages already completed.

Results Classification of question-responses is as in Experiment 1 (p. 49 above). Results from R and NR sentences have been collapsed as appropriate, as have results from the + nominal, pronominal and proper name which are regarded here as equivalent in terms of definiteness, by comparison with a + nominal¹⁸.

Data appear in Table 6:

Table 6: Response options by sentence-type (Experiment 2)

Sentence type	Response categories			Observed totals	Maximum possible totals
	<u>N1</u>	<u>E</u>	<u>N2</u>		
(a)	1	31	0	32	32
(b)	67	13	0	80	80
(c)	3	24	4	31	32
(d)	63	3	1	67	80
(e)	2	3	24	29	32
(f)	50	2	4	56	80

For sentence-types (a) through (d), entries represent the number of subjects who opt for one of the three response categories, and for sentence-types (e) and (f), entries represent the number of subjects

who make consistent options for these categories, "consistent" being defined as in Experiment 1.

The maximum number of subjects for sentence-types (a), (c) and (e) is equal to 32 (Group 1 and Group 5); and equal to 80 for types (b), (d), and (f) (Groups 2, 3, 4, 6 and 7) - cf: Tables 4 and 5. Departures from these maxima again arise where subjects have produced responses which are inconsistent and/or remain unclassified. Testing observed results against chance distributions for each sentence-type, we find where significant options have occurred: these are presented in Table 7 where they can be compared with the predictions of TC.

Table 7: Significant options for response categories N1, E or N2
(Experiment 2)

Sentence type	Options predicted (TC)	Options observed*
(a)	E	E (χ^2 : 38.74)
(b)	N1	N1(χ^2 : 60.99)
(c)	E	E (χ^2 : 18.09)
(d)	N1	N1(χ^2 : 74.07)
(e)	N2	N2(χ^2 : 21.24)
(f)	no prediction	N1(χ^2 : 52.57)

*All observed values of χ^2 are significant beyond the .001 level.

Discussion Results for both short and full passives clearly confirm all predictions of TC. It is again noticeable that for

full constructions with both nominals definitely marked (sentence-type (f)), subjects opt for N1, as VWO would predict (see Experiment 1). Experiments 1 and 2 might therefore be interpreted as indicating, not that VWO is wholly incorrect: for we do at times seem to depend on word-order for indication of importance (as is the case with languages other than English - e.g. Latin), but rather that it is restricted to certain types of construction: namely, full passives where both nominals are definitely marked. VWO therefore appears incomplete, for it takes no account of definiteness and will only account for full constructions which are either relatively infrequent, even in English, or atypical of languages in general. When both definiteness and the typical short form of passives are considered VWO is found unable to accommodate data which can be more readily accommodated under an alternative account which utilizes a distinction between the topic and comment of an utterance.

While these studies indicate the relevance of definiteness to determination of the "important entity" of both actives and short and full passives, we must next inquire as to the viability of the relation of definiteness to topicalization and presupposition relations in discourse.

It has already been suggested that in discourse the speaker must presuppose that his hearer has knowledge as to topic, the primary or important entity, and ignorance concerning comment: when such presuppositions are not met, communication either fails or becomes redundant. For example, suppose a speaker produces the utterance: "The village has one hundred inhabitants". As a prerequisite for successful communication, the speaker must presume

that his hearer knows which village is being referred to (= for "village" as topic, presuppose knowledge on the part of the hearer), otherwise communication fails. Further, the speaker must presume that his hearer is ignorant as to the information contained in the comment (= for "has one hundred inhabitants" as comment, presuppose ignorance on the part of the hearer), otherwise communication is redundant.

It was then suggested that indication of topic is provided by definiteness, so that in sentences which have two differentially determined nominals (a N + V + the N; the N + V + a N), topic is indicated by the nominal which is definitely marked. The basis of this assumption rested on an intuition reported by Harris (1751), where he suggests that use by the speaker of definite determiner the requires presupposition of knowledge in the listener: consider the following passage from his work:

A certain Object occurs ... What is it? ... An Individual -
Of what kind? Known or unknown? Seen now for the first
time, or seen before and now remembered? - 'Tis here we
shall discover the use of the two Articles A and THE. A
respects our primary Perception, and denotes Individuals
as unknown; THE respects our secondary Perception, and
denotes Individuals as known. To explain by an example -
I see an object pass by, which I never saw till then.
What do I say? - There goes A Beggar with A long Beard.
The Man departs, and returns a while after. What do I
say then? - There goes THE beggar with THE long Beard.
The Article only is changed, the rest remains unaltered.

Yet mark the force of this apparently minute Change. The Individual, once vague, is now recognised as something known, and that merely by the efficacy of this latter Article, which tacitly insinuates a kind of previous acquaintance, by referring the present Perception to a like Perception already past.

(Harris, 1951: 213 ff)

Now if Harris's intuition is correct: that use of the is tacitly indicative of previous knowledge, which it has been suggested speakers must presuppose in their listeners for communication to succeed, then there are good grounds for connecting topicalization with definiteness. Experiment 3 therefore attempts to test Harris's intuition in an empirical fashion.

Experiment 3

The specific hypotheses to be tested are detailed below after description of the experimental material and procedure.

Material Two short movie sequences were prepared and recorded on closed-circuit-TV video tape; each sequence showed a series of events involving persons and objects. One sequence (Clip A) involved a person who was known to experimental subjects, and the other sequence (Clip B) involved an unknown person.¹⁹ In each clip, these persons introduced objects that the experimental subjects had not particularly encountered before: an envelope in Clip A and a book in Clip B. After the envelope had been addressed in A, and the book opened and briefly read in B, the persons departed from camera view, returning a few seconds later to again work with their respective objects - the envelope was blotted in A, and notes were taken from the book in B.

Subjects 75 naturally English speaking undergraduates (approximately one third were male) of mean age 21 years (range: 18-26).

Procedure A deception procedure was employed, subjects being informed that they would be shown two film clips and then asked to give testimony on the events they had witnessed, either immediately after viewing or after a delay of up to one hour. Since the experiment was ostensibly intended to test the hypothesis that

accuracy of testimony was subject to impairment as a function of temporal delay between witnessing an event and reporting on it, subjects were prevented from taking any notes while the clips were being shown, but later provided with protocols on which to write out their testimony.

In reporting their testimony, each subject was allowed to use up to, but not more than eight sentences, each of which had to be grammatical. The former instruction was given to prevent excessively lengthy pieces of testimony, the latter to prevent use of cryptic notes that omitted use of articles (e.g. "man sat down - wrote on envelope"). After protocols had been completed and handed in, subjects were issued with a check-list which asked if the persons in Clips A and B were familiar or unfamiliar. To allow counterbalancing in the order of presentation of Clips A and B, subjects were run in four groups of about twenty subjects per group.

Hypotheses In each piece of testimony we distinguish first and second mention of persons and objects. Since each clip involved the departure and return of the person mid-way through the clip, first mention refers to initial mention of the person and object nominals in the first half of a clip, and second mention refers to initial mention of these nominals in the second half of a clip (i.e. after departure and return of the persons). Before setting out the hypotheses in detail, the characteristics of the material are first summarized:

Clip A: person known to subjects appears, introduces unknown object (envelope) which is manipulated (envelope addressed); known person departs and then returns, the person being still known, to again manipulate the object which is now known (envelope blotted).

Clip B: person unknown to subjects appears, introduces unknown object (book) which is opened and consulted; unknown person departs and then returns, the person now being known, to take notes from the book which is likewise now known.

We are testing the hypothesis that while persons or objects which are known will be definitely marked, those which are unknown will not be marked for definiteness. Specific hypotheses H1 through H8 are set out in Table 8, where DM = definitely marked (person or object) nominals, and NDM = non-definitely marked nominals.

Table 8: Hypotheses in Experiment 3

Hypothesis	Clip	Nominal	Prediction
H1	A	Object	First mention : NDM (unknown)
H2			Second mention : DM (now known)
H3	B	Object	First mention : NDM (unknown)
H4			Second mention : DM (now known)
H5	A	Person	First mention : DM (known)
H6			Second mention : DM (still known)
H7	B	Person	First mention : NDM (unknown)
H8			Second mention : DM (now known)

Results Protocols of testimony were withdrawn where subjects did not know the person in Clip A, did know the person in Clip B, used cryptic notes, or failed to mention the persons or objects in

the second half of the clips. 75 protocols remained available for analysis.

Classification of responses appears in Table 9:

Table 9: Classification of responses (Experiment 3)

Nominals	D.M. (definitely marked)	NDM (non-definitely marked)
Person	proper name the + nominal pronoun	someone a + nominal
Object	the + nominal	a + nominal

Results are presented in Table 10 where entries represent the number of subjects who definitely, or nondefinitely, mark the person and object nominals in their first and second mentions.

Table 10: Responses (Experiment 3)

Clip	Nominal	Total responses	First mention		Total responses	Second mention	
			DM	NDM		DM	NDM
A	Object	75	1	74 (H1)	75	75	0 (H2)
B	Object	75	1	74 (H3)	75	75	0 (H4)
A	Person	75	44	31 (H5)	75	75	0 (H6)
B	Person	75	5	70 (H7)	75	75	0 (H8)

By inspection, all hypotheses are clearly confirmed except H5 where first mention of the person in Clip A was predicted as DM since this person was known to subjects. While 59% of subjects do mark

this person-nominal as DM, this result does not depart significantly from chance. Since the rest of the data is quite clear-cut, it seems likely that some variable is confounding this particular result, and the confounding variables are perhaps just those under examination - i.e. subjects who presumed that the reader of their testimony would, like themselves, know the person in Clip A, have marked the person-nominal definitely, while subjects who made no such presupposition have marked the person-nominal non-definitely. The considerable proportion of the latter type of response (41%) may perhaps be indicative of an attempt at objectivity, given the nature of the deception task: the provision of testimony. This hypothesis was therefore examined in Experiment 4.

Experiment 4

Material As in Experiment 3.

Subjects 15 undergraduates, similar to those of Experiment 3.

Procedure Subjects were instructed as in Experiment 3 except that they were further informed that the person who would read their pieces of testimony would be familiar neither with the film clips themselves, nor with the persons, objects and events depicted.

Hypotheses Hypotheses are as in Experiment 3 with the exception of H5. Since subjects have been instructed that they may not presuppose that the reader of their testimony will know the person in Clip A, H5 now changes from DM (known to subjects and the reader of testimony) on first mention to NDM (known to subjects but unknown to the reader).

Results Classification of responses is as before. Results are presented in Table 11, entries again representing numbers of subjects.

Table 11: Responses (Experiment 4)

Clip	Nominal	Total responses	First mention		Total responses	Second mention	
			DM	NDM		DM	NDM
A	Object	15	0	15	15	15	0
B	Object	15	2	13	15	15	0
A	Person	15	4	11(H5)	15	15	0
B	Person	15	0	15	15	15	0

As before, all hypotheses are clearly confirmed except H5, where comparison of the distribution of observed responses with a chance distribution yields a value of χ^2 (with Yates' correction) of 3.33 ($df = 1$, $p < .10$). However, whereas 59% of responses were as predicted in Experiment 3, in the present experiment 73% of responses are as predicted. While a replication of Experiment 4 could clear up this point by increasing N to improve reliability of the data²⁰, the results of Experiments 3 and 4 appear to provide sufficient empirical validation of Harris's intuition. Thus use of definite determiner the does involve previous knowledge, and, what is perhaps more interesting, Experiments 3 and 4 also suggest the relevance of presuppositions about such previous knowledge on the part of participants in discourse.^{21, 22}

Discussion We can now better appreciate our reaction to traditional criticisms of Piaget's studies of cognition which employ language as a vehicle for study. In response to the suggestion (e.g. Flavell, 1963: 437) that should one suspect that "language" plays a significant role in Piaget's studies, one need only manipulate the "verbal aspects" of the task, it was pointed out that the essential difficulty of this position lay in deciding which verbal aspects to examine. In the absence of an established literature on this topic, we therefore considered an account of the communicative function of linguistic structure, since a notable aspect of Piaget's tasks involves communication in discourse exchanges between the adult experimenter and the child subject. However, it appears that the account examined - VWO, which suggests that variation in the syntactic aspects of utterances serves certain

communicative functions - is limited, for an alternative account (TC, which distinguishes the topic and comment of an utterance) can better accommodate data obtained in experiments which recognise the relevance of semantic aspects of utterances (Experiments 1 and 2), these semantic aspects: marking nominals for definiteness or non-definiteness, being related both to previous knowledge of such nominals (Experiment 3) and to presupposition relations holding between participants in discourse (Experiment 4). These results hold for both active and passive sentences - i.e. regardless of variation in the syntactic form of utterances. Thus in considering communication in discourse exchanges, semantic factors appear especially relevant.

At this point, it might be argued that the notion that semantic aspects of language use are primary to syntactic aspects runs counter to a recently expressed view of Piaget (Piaget & Inhelder, 1969) who, in commenting on studies of Sinclair (1969), appear to read some significance into syntactic aspects of the child's utterances. In these studies, tasks involving comparison were presented to children who showed: (a) complete ability to conserve, (b) no ability to conserve, subjects being presented with tests of both comprehension and production (the former being tested by issuing the child with instructions, the latter by asking the child to produce descriptive utterances). For example:

We present the child with two dolls, to one of whom we give 4 big marbles and to the other 2 small marbles, and we ask: Is this fair? Are both dolls happy? Why not?

Or we ask him to tell us the difference between two pencils, e.g. a short thick one and a long thin one. After this exploration of the child's use of certain expressions, we studied his comprehension, by asking him to execute orders couched in "adult" but simple terms (e.g. "give more plasticine to the boy than to the girl"; "find a pencil that is shorter but thicker than this one").

(Sinclair, 1969: 322)

While there was no difference between the groups as regards comprehension, Sinclair reports "striking differences" between the groups as regards production - i.e. their descriptions differed, for whereas 70-100% of Group A (complete conservation) used "comparatives" (e.g. <<Le garçon a plus que la fille>> - "The boy has more than the girl") for the description of different quantities of mass (plasticine) and count (marbles) noun objects respectively, 90% of Group B (no conservation) used "absolute terms" (e.g. <<Le garçon a beaucoup, la fille a peu>> - "The boy has a lot, the girl has a little")²³. Sinclair also reports that while 100% of Group A used different terms for different dimensions (e.g. <<grand/gros; petit/mince>> - "big/fat; little/thin"), 75% of Group B used one word for two dimensions (e.g. <<gros>> for "long" and for "thick", <<petit>> for "short" and for "thin"). Further, 80% of Group A co-ordinated the description of two dimensions (<<Ce crayon est long mais mince, l'autre est court mais gros>> - "This pencil is long but thin, the other is short but thick"); but 90% of Group B failed to co-ordinate in this way, instead dealing with one dimension

at a time (((Ce crayon est long, l'autre est court; ce crayon est mince, l'autre est gros)))).

From these studies, Sinclair concludes:

A distinction must be made between lexical acquisition and the acquisition of syntactical structures, the latter being more closely linked to operational level than the former .. Operational structuring and linguistic structuring .. thus parallel each other.

(Sinclair, 1969: 324,325)

In commenting on these studies, Piaget also notices the "surprising degree of correlation between the language employed and the mode of reasoning" (Piaget & Inhelder, 1969: 90). But the question that Piaget then raises concerns the interpretation of these results:

How should this relationship be interpreted? A child at the preoperatory level understands the expressions of the higher level when they are integrated into orders or assignments ("Give that man a longer pencil", etc.), but he does not use them spontaneously. If you train him to use these expressions, he learns them but with difficulty, and the training seldom influences his notions of conservation (it does in approximately one case in ten).

(Piaget & Inhelder, 1969: 90)

The conclusion drawn by Piaget is that "these data .. indicate that language does not constitute the source of logic, but is, on the contrary, structured by it" (Sinclair, 1969: 325, reaches precisely the same conclusion). However while Piaget's conclusion is clear: no fundamental importance can be attached to language in the development of cognitive abilities, the grounds of this conclusion seem rather obscure, for on looking closely at the arguments above, a confusing admixture of views is revealed:

- (i) The two groups of children differ in their cognitive abilities (ability to conserve).
- (ii) The two groups differ insofar as syntactic aspects of their descriptive utterances (language production) differ.
- (iii) Thus there is a "surprising correlation" between the structure of the language the children produce and their cognitive abilities.
- (iv) However there is no difference between the groups as regards their ability to comprehend the language involved in presented instructions.

It is not at all clear whether Piaget wishes to regard the differences in the syntax of language production as significant. Initially it appears that he does, but if this is so, there are both formal and empirical grounds for complaint. For example, the notion that utterances involving "comparatives" and utterances involving "absolute terms" ^{do not} differ, ^{except} superficially, has recently been suggested by Campbell & Wales (1969), who

suggest that utterances containing absolutes must be linguistically derived from comparatives. E.g. utterances containing absolute terms like: John is tall, are characterised as implicit comparatives; John is tall (er than \emptyset), where \emptyset is some standard; otherwise we could never have the perfectly acceptable utterance John is tall, where John is a child.²⁴

However Piaget's position does not lend itself to criticism on formal grounds alone - recent empirical studies have suggested that Sinclair's data do not enjoy stability, for the notion that preconservers produce absolutes rather than comparatives in language production is not supported by the data of Campbell & Wales (1970: 251) who report observation of a variety of comparatives (so-called absolutes, full comparatives, functional comparisons and superlatives) in the spontaneous language production of 3-4 year olds; and the notion that utterances containing absolute terms function differently from utterances containing comparatives is not supported by the data of Wales (1970), who reports that children accord a comparative interpretation to utterances involving absolute adjectives.

It is, however, perhaps superfluous to adduce arguments and data which suggest that a distinction between "absolutes/scalars" and "comparatives/vectors" is more apparent than real, for it is not in any case clear whether Piaget wishes to regard this "distinction" as significant. Although Piaget initially appears to argue that there is "a striking correlation" between language structure and mode of cognitive functioning²⁵, he then points out that there is no difference between the groups as regards their linguistic comprehension.²⁶ From this, he now appears to argue that if there

are no significant differences between the groups as regards language (comprehension) and yet if there are significant differences between the groups as regards cognition (ability to conserve), then this indicates that language and cognition are not fundamentally related. However this does not follow, for Sinclair and Piaget did not undertake study of the linguistic aspects of conservation tasks: "We explored the child's verbal capacities .. by asking him to describe simple situations which do not touch upon conservation .." (Sinclair, 1969: 322; emphasis introduced). Since the eliciting contexts (tests of cognitive and linguistic abilities) were kept separate, one cannot argue from the one to the other with any degree of confidence. Precisely the same argument applies to Sinclair's attempt to induce conservation responses via "verbal training" (cf: Sinclair, 1969: 322 ff) - the contexts were completely distinct.

Although Piaget's position on the importance of syntax is difficult to understand, what does seem to emerge is that Piaget himself is not prepared to pay too much attention to superficial differences in the syntax produced in discourse between subject and experimenter. This would suggest that the conclusion obtained in the present chapter - that in considering communication in discourse, semantic factors appear especially relevant - does not necessarily run counter to the views of Piaget and Sinclair, their initial attention to superficial syntactic variables notwithstanding. It is therefore to semantic aspects of class inclusion that we now turn in Chapter 4.

Chapter 4

Studies of class inclusion

When one comes to consider semantic aspects of class inclusion, a number of anomalies becomes apparent. First there is the anomaly concerning what have been termed "equational sentences" (cf: Jakobson, 1960) and inclusion questions: the child is able to produce and comprehend equational sentences like: "a dog is an animal", "a primula is a flower", long before he can deal with inclusion questions; "are there more dogs than animals", "are there more flowers or more primulas". Success with the former type of utterance suggests that the child can appropriately handle the semantics of such terms as dog, cat, animal, etc. apparently appreciating that a member of a subclass (e.g. a dog) is also a member of the class from which it is drawn (i.e. the class of animals); but the concurrent lack of success with inclusion questions either suggests that the child is unable to deal appropriately with the semantics of class and subclass terms which class inclusion questions involve, or, as Piaget prefers to argue, that the child's lack of success does not arise from an inability to handle semantic aspects of the task, but rather from an inability to handle

the operations of inclusion in a logically co-ordinated fashion.

Second, there is the anomaly concerning just these operations, for the child is apparently able to handle relations of composition and decomposition in a context of what have been termed "subtraction questions" (p.17 above), but not in a context of inclusion questions. Given a class composed of two types of flower, the child will answer that one subclass remains on removal of the other ($B-A = A'$ or $B-A' = A$ - decomposition), while removal of the class involves removal of both subclasses ($B = A+A'$ - composition): recall the protocol of THE:

If you picked all the primulas in a field, would there be any flowers left? - Yes. Now supposing you picked all the flowers, would there be any primulas left? - Yes ... no. Why? - Because you're taking all the flowers.

(Inhelder & Piaget, 1964: 104, 105)

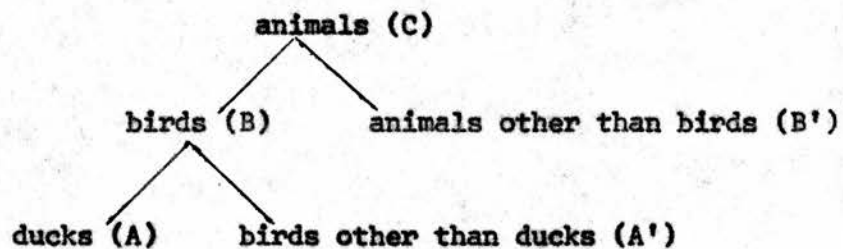
Thus the child seems able to deal with the semantics of such terms as primula, flower etc. in one context of questions (subtraction), but not in another (inclusion).

Third, there is the inconsistency in Piaget's account of erroneous responses to inclusion questions which might also be subsumed under a general heading of "semantic aspects of class inclusion": when the child is unable to compare a class with one of its parts (inclusion), Piaget suggests that the child in fact compares the subclasses. But whereas in minority inclusion questions ($A' \subset B$) the major subclass A is "simply called" by the class term B, in majority inclusion questions

(A/B) no such process occurs (see p. 22 above). Hence a semantic process: whereby a subclass is referred to by the class name, is held to occur with one type of inclusion question (minority), but not with another (majority).

However there appears to be yet a further anomaly concerning the semantics of class inclusion. This arises from a report of Piaget's, that children who succeed with class inclusion questions in some contexts of application (e.g. with classes of flowers, beads, geometric shapes, etc.) may nevertheless exhibit lack of success in other contexts (e.g. with classification of animals). In a study with a sizeable group of subjects ($N = 117$) aged 7-14 years, Piaget reports that when inclusion questions were presented with respect to pictures of animals rather than flowers, results with animals "systematically lagged behind" results with flowers (Inhelder & Piaget, 1964: 110). Using material as depicted in Figure 4, Piaget reports that not only can 7-13 year-old subjects

Figure 4



fail to handle class inclusion questions, but can even fail to construct the appropriate heirarchical system:

We found that neither the heirarchical system (A/B(C) nor the quantification of inclusion were properly understood...

A number of subjects were nearly at the stage of formal operations (i.e. about 11-14+ years) by the time they showed such understanding. Subjects who answered other questions (i.e. with classes of flowers, beads, shapes etc.) at the level of stage-3 often gave replies equivalent to those of stage-1 when dealing with animals.

(Inhelder & Piaget, 1964: 112)

Piaget's explanation of these findings, which he admits to be a posteriori, runs as follows:

That different results are obtained when animals are used must be due to the fact that these classes are more remote from everyday experience and therefore more abstract. It is true that circles and squares, or primulas and flowers, are designated by words which evoke verbal concepts of a general kind and are therefore abstract. But children do play about with circles and squares between the ages of 5 and 9; and unless they are city dwellers they often pick flowers or just primulas either in their gardens or when they go for a walk. Now using pictures of ducks and other birds and animals should make precious little difference if the questions are still confined to the actual pictures on the table. Each one of these represents a perfectly familiar object and there is no difficulty about naming them. There is certainly no explicit reference to the highly generalized conceptual structure which lies behind this nomenclature. But in fact (this is our a posteriori

explanation of the results), a child cannot say that ducks are birds and birds are animals by simply relying on experience drawn from his own actions, as he can for squares and circles which he has drawn and for flowers which he has picked. He is compelled to rely far more on purely linguistic concepts and he may need to structure and develop these in the course of the actual experiment. This explains the time lag.

(Inhelder & Piaget, 1964: 110, 111)

Thus Piaget's proposed explanation is that results with animals lag behind those obtained with other classes of objects because classes of animals "are more remote from everyday experience and therefore more abstract".

However some further remarks of Piaget suggest an alternative:

Their difficulty in comparing the part with the whole in this domain must be due to the fact that zoological classes are not very clearly defined for them. Ducks, for Pie, are not birds; for Esc, ducks do not have wings and sea-gulls are not birds, etc. Spontaneous classifications are frequently made in terms of more familiar properties instead of the abstract verbal categories of birds and animals. Stod, for instance, suggests classifying the animals as wild and tame, or as large and small. Esc can find no surer criterion than to examine the cards to see whether the creatures are depicted with open wings (giving a class which includes insects and sea-gulls), or

with closed wings. The most frequent classification is into animals that fly and animals that walk. But one sometimes finds very strange mixtures; Stod, for instance, begins with a class of insects, but goes on to put the ducks with the mice ("fairly small animals"), and the birds with the frogs.

(Inhelder & Piaget, 1964: 114)

Thus Piaget's subjects may fail to recognise that ducks are birds as are sparrows, parrots etc. or that birds are animals as are mice, horses, dogs, etc. (cf: Lovell, Mitchell & Everett, 1962). Thus there appears to have been a lack of agreement between S and E as regards the semantic nature of the experimental material. This alone might account for subjects' inability to construct the appropriate hierarchy of classes, far less answer inclusion questions. Piaget's explanatory hypothesis therefore appears to require further examination.

A point to notice about Piaget's explanation is that the notion that animals are more remote from subjects' everyday experience than are flowers is no more than an assumption. For example, one might argue that urban children living in town centres are just as likely to have come into contact with animals as with flowers, for while many urban households have no garden, they often possess domestic pets. However this sort of variable can be effectively controlled by use of artificial material, labelled with nonsense syllables, which the child could not possibly have encountered before the experiment.

In the following experiment subjects' performance on material which Piaget holds to be within the child's everyday experience

(e.g. flowers) is therefore compared with performance on specially constructed nonsense-material, genuinely "remote" from the experience of the child.

Experiment 5

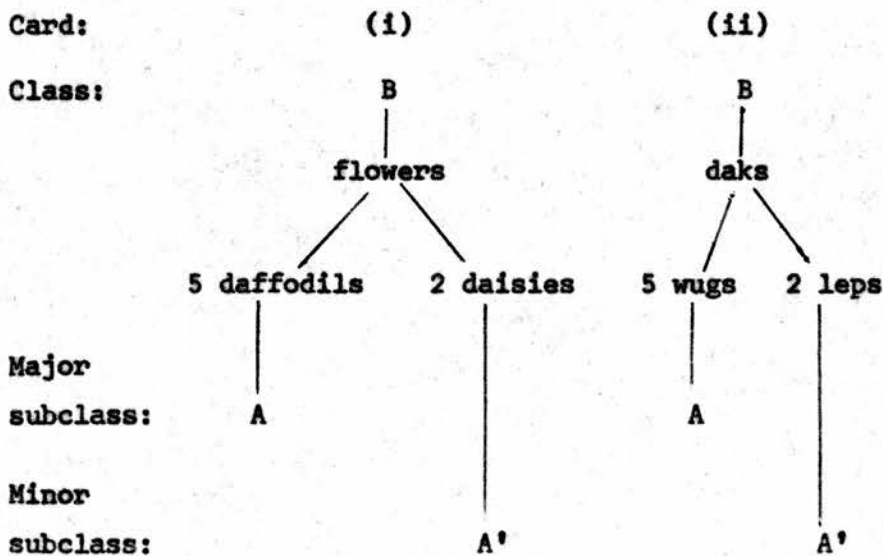
Subjects 24 naturally English speaking schoolchildren,
assigned to two equal groups on the basis of age:

Group 1 (n = 12, 6 male) of mean age 6;10 years (range: 5;6-8;7)

Group 2 (n = 12, 7 male) of mean age 10;2 years (range: 9;10-12;0)

Material Outline drawings on white cards (6 x 4"), representing
the classes of Figure 5:

Figure 5



On Card (ii) wugs were similar to the duck-like nonsense figures employed by Berko in her studies of morphology (Berko, 1958),

and leps were fat caterpillar-like nonsense figures.

Procedure Subjects were tested individually by the same experimenter. Ss were informed that E had some pictures which they were going to look at, and that E would ask some questions about them. (This same preamble was used in all subsequent experiments).

Card (i) was introduced, S informed that this was a picture of flowers, and the referents of the subclasses (daffodils and daisies) indicated. Details were then checked:

Let's go over it again. This is a picture of ..? Yes, flowers. These (pointing) are .. ? Yes, daffodils. These (pointing) are ..? Yes, daisies.

The same procedure was employed with Card (ii). After introduction of each card, three comparison questions were presented; these involved:

- (a) comparison of subclasses A and A' (A:A' - subclass comparison)
- (b) comparison of subclass A' and class B (A'B - minority inclusion question)
- (c) comparison of subclass A and class B (A(B - majority inclusion question)

The form of the question was always: "Are there more __ or more __?", the questions being presented first in one order of presentation (A':A, A'(B, A(B), then in reverse order (A:A', B(A', B(A)'. This provides two responses per type of comparison, and checks the consistency of the child's response - unless the child answers correctly on both orders of presentation, he is not credited with a correct response.

Results Data appear in Table 12 where entries represent the number of subjects per group (maximum: 12) who produce consistently correct responses on the three types of comparison question. Results for the familiar material of Card (i) are compared with those for the unfamiliar material of Card (ii).

Table 12: Correct responses (Experiment 5)

Group	Material	Comparison		
		$A:A'$	$A'(B)$	$A(B)$
1	familiar	11	7	5
	unfamiliar	5	2	0
2	familiar	12	11	8
	unfamiliar	10	10	8

With the younger subjects (Group 1) there are significant differences between familiar and unfamiliar material for all three types of comparison ($A:A':-z = 2.12$, $p(<.05)$; $A'(B):-z = 2.24$, $p(<.05)$; $A(B):-z = 2.24$, $p(<.05)$). With the older subjects of Group 2, there is no significant difference between familiar and unfamiliar material on any type of comparison.

Discussion With reference to the inclusion question presented by Piaget ($A(B)$), although we observe a difference in performance on familiar and unfamiliar material that Piaget's views might lead us to expect, this is clearly restricted to the younger subjects, for the older subjects of Group 2 exhibit no such difference. Further, although the younger subjects have found $A(B)$ inclusion questions

significantly more difficult with unfamiliar material, they have also found A:A' subclass comparisons, and A'(B inclusion comparisons, significantly more difficult. This suggests that significant decreases in performance are not simply due to differences in the familiarity of the material, but rather due to difficulties with naming. With unfamiliar material, the significant decrease in performance on comparison of subclasses (A:A') in the younger group suggests that they have experienced difficulty in keeping track of the appropriate subclass names, leading to consequent difficulty with inclusion question. The older subjects however show no decrease in performance on comparison of subclasses, nor on inclusion questions.

These results therefore fail to confirm the hypothesis that performance deteriorates with material which is unfamiliar, simply because it is unfamiliar per se.¹⁸ Thus Experiment 5 suggests that the differences in performance which Piaget observed with flowers and animals as material are not to be accommodated in the manner which he proposes.

However, despite failing to confirm Piaget's proposed explanation of differences in performance being due to unfamiliarity or remoteness, the results of Experiment 5 are not wholly negative, for they indicate an alternative hypothesis for investigation: namely, decrease in performance seems linked with difficulty in appropriately naming the constituents of the experimental material.

The possibility of such a link is reinforced by arguments of Brown (1958), to the effect that children learn to name objects which compose such classes as animals and flowers in a different

manner - whereas the names learned for the former objects are invariably subclass names (e.g. dog, cat), the name learned for the latter objects is invariably the class name (i.e. flower). Brown argues that the child learns more specific (subclass) names for objects which the adult expects him to distinguish, but (class) names of wider generality for objects which he is not expected to distinguish. Thus the specificity or generality of object-names acquired by the child is interpreted as a function of the discriminatory abilities expected of the child by adults.

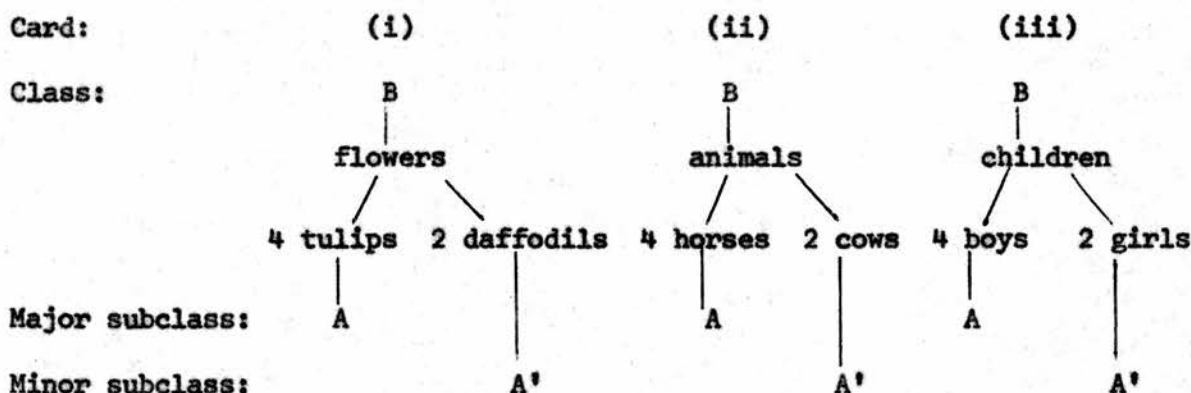
If Brown is correct in suggesting that there are differences in the child's learning of names of objects which compose different classes like animals and flowers, and if there is a link between the abilities to name and compare classes and subclasses (as the data of Experiment 5 suggest), then this line of inquiry seems worth pursuing. These notions are therefore explored further in Experiment 6 where we present different classes of objects and observe: (i) any differences in the naming of their constituents; (ii) any differences in ability to make class/subclass comparisons.

Experiment 6

Subjects 36 naturally English speaking schoolchildren (24 male) of mean age 6;0 years (range: 5;0 - 6;10).

Material Outline drawings on white cards (6 x 4") representing the classes of Figure 6:

Figure 6



Procedure (See the preamble on p.82 above). Cards (i) - (iii) were presented in random order. On presentation of each card, S was asked what the "pictures" showed. If the child initially named the objects with the class name, he was then asked to name the subclasses; alternatively, if he initially produced subclass names, he was then asked to name the class. As we will come to see, there were consistent differences in subjects' naming behaviour between cards: for Card (i), the initial response was invariably to give the class name and then

fail to give the subclass names; for Cards (ii) and (iii), subjects first gave the subclass names and then met with some success in giving the class names. This can be illustrated with a typical protocol for each card:

Card (i) What is this a picture of? - Flowers. Yes, this is a picture of flowers. What are these (pointing to one of the subclasses)? - Don't know. These are tulips; what are they? - Tulips. Show me the tulips - (child points to tulips). Good. What are these (pointing to the other subclass)? - Don't know. These are daffodils; what are they? - Daffodils. Show me the daffodils - (child points to daffodils). Good. So this is a picture of? ... Daffodils. And ...? - Tulips. Good. And what are daffodils and tulips? - Flowers.

Card (ii) What is this a picture of? - Horses. Yes, show me the horses - (child points to horses). Good; what are these (pointing to cows)? - Cows. Yes show me the cows - (child points to cows). Good; what are horses and cows, what do we call them? - Don't know (24 out of 36 subjects). Horses and cows are animals; what are they? - Animals. Yes, so this is a picture ofetc.

Card (iii) What is this a picture of? - Boys ... and girls. Yes, show me the boys (child points to boys), and now the girls, (child points to girls). Good; what are

boys and girls, what do we call them? - Don't know
 (20 subjects out of 36). Boys and girls are children;
 what are they? - Children. Yes, so this is a picture
 of etc.

When this naming procedure had been completed, the cards were shown again and comparison questions presented, the form of the questions being held constant: "Are there more ___ or more ___?". The questions involved the three types of comparisons studied in Experiment 5:

- (a) comparison of subclasses ($A:A'$ - e.g. "Are there more boys or more girls")
- (b) comparison of minor subclass with class ($A'B$ - e.g. "Are there more girls or more children")
- (c) comparison of major subclass with class ($A'B$ - e.g. "Are there more boys or more children").

Each subject answered all types of comparison question, but always with a different material content (e.g. $A:A'$ against flowers, $A'B$ against animals, $A'B$ against children). For each subject, the cards and associated comparison questions were presented three times. Order of presentation of questions, order of terms within questions, and associated material content, were counterbalanced across subjects.

Results Data on the spontaneous naming of the experimental material appear in Table 13 where entries represent the number of subjects who can provide class and/or subclass names for the objects depicted on Cards (i) - (iii) without the help of the experimenter:

Table 13: /

Table 13: Naming responses (Experiment 6)

Class	Naming responses	Major subclass	Naming responses	Minor subclass	Naming responses	Total
flowers	29	tulips	10	daffodils	3	42
animals	12	horses	35	cows	22	69
children	16	boys	36	girls	36	88

As already mentioned, there are clear differences in the way in which the material is spontaneously named. Whereas most subjects (29 out of 36) give the class name for flowers, few can name the subclasses. And while practically all subjects name the subclasses of animals and children, less than half (12-16 out of 36) can give the class names. Thus while subjects distinguish by name between different types of animal and (male and female) child, they do not distinguish by name between different types of flower.

Thus for naming responses, out of a possible maximum 108 responses per class (36 subjects x 3 constituent names per class), 42 correct responses were observed for the class of flowers, 69 for animals and 88 for children.

With regard to correct responses to comparison questions (a), (b) and (c), out of a possible maximum 108 responses per class (36 x 3 presentations per comparison), 34 correct responses were observed for the class of flowers, 56 for animals and 75 for children.

The mean correct responses for these classes of material on naming, and subsequent comparison, appear in Table 14:

Table 14: Mean correct naming and comparison responses (Experiment 6)

Responses	Class		
	<u>flowers</u>	<u>animals</u>	<u>children</u>
Naming	1.17	1.92	2.44
Comparison	0.94	1.56	2.08

Differences between these means are statistically reliable: comparing the classes of flowers and animals, $z = 4.386$ for naming responses, $z = 2.791$ for comparison responses; comparing the classes of animals and children, $z = 2.998$ for naming responses, $z = 2.356$ for comparison responses; all these values of z are significant at least beyond the .05 level. Thus the ability to make correct comparisons increases with the ability to spontaneously name the objects referred to in the comparison questions.

Discussion The results of Experiment 6 apparently lend support to the notion of a link, suggested by Experiment 5, between the child's ability to name and compare.

However while Experiments 5 and 6 suggest the existence of a relationship between such abilities, they provide little information as to the nature or characteristics of this relationship, for the experimental data so far presented fail to inform us as to the processes which might be held to underlie the child's responses. Since such information is essential if a resolution of the apparent

anomalies in Piaget's account of class inclusion is to be attempted, we therefore attempt to obtain such information in Experiment 7, where a smaller group of younger subjects is studied in a more intensive fashion.

Experiment 7

Subjects 12 naturally English speaking pre-school children (8 male) of mean age 4;8 years (range: 4;2 - 5;1).

Material Cards (i) - (iii) of Experiment 6 were employed, showing flowers (4 tulips and 2 daffodils), animals (4 horses and 2 cows) and children (4 boys and 2 girls) respectively. A minor change in this material involved colouring the flowers: instead of requiring subjects to discriminate the different types of flower solely on the basis of petal-shape, an additional cue was provided for these younger subjects by colouring the tulips red and the daffodils yellow.

A further three cards ((iv) - (vi)) were prepared by simply reversing the subclass ratios of Cards (i) - (iii): thus whereas Card (i) showed 4 red tulips and 2 yellow daffodils, Card (iv) showed 2 red tulips and 4 yellow daffodils; and so for Cards (v): 2 horses and 4 cows, and (vi): 2 boys and 4 girls.²⁹

Procedure (Preamble, p.82 above) Cards (i) - (iii) were presented in random order, and S asked to name the constituent objects as in Experiment 6. When details of the child's ability to spontaneously name the constituent material had been obtained, Cards (i) - (vi) were presented with comparison questions in a manner similar to Experiment 6. As before, the questions were of

three types, involving comparisons between subclasses ($A:A'$), class and minor subclass ($A':B$), and class and major subclass ($A:B$). Each S answered all three types of question against each type of material, the general question form being held constant as: "Are there more ___ or more ___?". Order of presentation of cards and of types of comparison question were counterbalanced across subjects.

Results Data on the spontaneous naming of the experimental material appear in Table 15 where entries represent the number of subjects (maximum: 12) who respond correctly.

Table 15: Naming responses (Experiment 7)

Class	Naming responses	Subclass	Naming responses	Subclass	Naming responses	Total
flowers	6	tulips	1	daffodils	2	9
animals	0	horses	11	cows	5	16
children	1	boys	10	girls	11	22

While there are differences in these results compared with the older group of subjects in the previous experiment, a similar pattern emerges nevertheless: while most subjects name the subclasses of animals and children, but fail to name the classes, the opposite is true of flowers, where subjects name the class rather than the subclasses.

Results with the comparison questions appear in Table 16 where both correct and incorrect responses are recorded for each class of material and type of comparison; there is a total of 24 responses

in each instance, since each subject is presented with two cards (ratios reversed) per class:

Table 16: Comparison responses (Experiment 7)

Comparison	Material	Total responses	Response			Correct responses
			<u>B</u>	<u>A</u>	<u>A'</u>	
A(B	children	24	1	21	2	4%
	animals	24	3	19	2	12%
	flowers	24	16	7	1	67%
A'(B	children	24	15	6	3	63%
	animals	24	14	4	6	58%
	flowers	24	6	0	18	25%
A:A'	children	24	0	19	5	79%
	animals	24	0	18	6	75%
	flowers	24	0	8	16	33%

It is difficult to imagine a more intriguing set of results, whose two most striking features are these: first, data obtained with animals and children conform in detail to the pattern customarily reported in the literature: namely, subjects succeed in comparing subclasses (A:A' comparisons are 77% correct), apparently succeed in comparing class and minor subclass (A'(B comparisons are approximately 61% correct), but fail to compare class and major subclass (A(B comparisons are 8% correct). Second, data obtained with flowers apparently bear no relation to these results, for subjects generally fail to compare subclasses (A:A' - 33% correct), fail to compare class and minor subclass (A'(B - 25% correct), yet

apparently succeed in comparing class and major subclass ($A \subset B \pm 67\%$ correct).

Further analysis of responses confirms this impression. Table 17 shows appropriate values of z for comparisons between the three classes of material:

Table 17: Statistic values (Experiment 7)

Comparison	children - animals	flowers - children	flowers - animals
A \subset B	1.57	4.81**	4.13**
A' \subset B	0.30	2.31*	2.05*
A:A'	0.35	2.91**	2.61**

* $p < .05$

** $p < .01$

Thus there are no significant differences in results between children and animals on any type of comparison question, while results obtained with flowers are significantly different from both these classes on all three types of comparison.

Before undertaking discussion of these data, some estimates of their reliability is clearly required. Thus in the following experiment, the present experiment is repeated with a different group of subjects.

Experiment 8

Subjects⁸⁰ 12 naturally English speaking pre-school children (5 male) of mean age 4;9 years (range: 4;5 - 5;2).

Material As for Experiment 7.

Procedure As for Experiment 7.

Results⁸¹ Subjects' ability to spontaneously name the experimental material conformed to the by now familiar pattern: with classes of animals and children, subclasses rather than classes were named, whereas with the class of flowers, subjects named the class but not the subclasses.

With the comparison questions, the pattern of data, as presented in Table 18, is also similar to that of Experiment 7:

Table 18: Comparison responses (Experiment 8)

Comparison	Material	Total responses	Response			Correct responses
			<u>B</u>	<u>A</u>	<u>A'</u>	
A < B	children	24	2	22	0	9%
	animals	24	6	18	0	25%
	flowers	24	14	8	2	58%
A' < B	children	24	18	3	3	75%
	animals	24	16	7	1	67%
	flowers	24	6	1	17	25%
A : A'	children	24	0	19	5	79%
	animals	24	0	20	4	83%
	flowers	24	0	8	16	33%

With the classes of animals and children, subjects succeed with A:A' comparisons (81% correct), apparently succeed with A'(B comparisons (71% correct), but fail with A(B comparisons (17% correct).

However, as in Experiment 7, results with the class of flowers are strikingly different - A:A' comparisons: 33% correct; A'(B comparisons: 25% correct; A(B comparisons: 58% correct.

Further analysis again confirms this impression - consider the appropriate values of z in Table 19:

Table 19: Statistic values (Experiment 8)

Comparison	children - animals	flowers - children	flowers - animals
A(B	1.94	3.98**	2.63**
A'(B	0.17	3.18**	2.61**
A:A'	0.37	2.91**	3.22**

** $p < .01$

Again, there are no significant differences in results between classes of children and animals on any type of comparison, while results obtained with flowers are significantly different from both these classes on all three types of comparison.

Thus the results of Experiment 8 suggest that the data of Experiment 7 are stable, the patterns of response in each case being virtually identical. For convenience in subsequent discussion, the results of both experiments have been collapsed in Table 20:

Table 20: Responses (collapsed data of Experiments 7 and 8)

Comparison	Material	Total responses	Response			Correct responses
			<u>B</u>	<u>A</u>	<u>A'</u>	
A<B	children	48	3	43	2	6%) 13%
	animals	48	9	37	2	19%)
	flowers	48	30	15	3	63%
A'<B	children	48	33	9	6	69%) 66%
	animals	48	30	11	7	63%)
	flowers	48	12	1	35	25%
A:A'	children	48	0	38	10	79%) 79%
	animals	48	0	38	10	79%)
	flowers	48	0	16	32	33%

Discussion The results of these two experiments suggest that when subjects are familiar with the subclass-names of objects (e.g. boy, girl, horse, cow) their responses to comparison questions conform to the pattern previously reported in the literature: namely, they succeed with A:A' questions, apparently succeed with A'<B questions, but fail with A<B questions. However when the subclass-names are unfamiliar (e.g. tulip, daffodil), responses depart from this pattern, subjects now failing with A:A' and A'<B questions, but apparently succeeding with A<B questions.

These results might be explained as follows: subjects, being unfamiliar with the names of the subclasses of flowers, have simply confused the subclass-names, the appropriate referents of each being

transposed - i.e. "daffodils" and "tulips" have been confused, the former name being taken as applicable to the tulips and the latter name as applicable to the daffodils. This is suggested by the lack of success with $A:A'$ comparisons, where of 48 responses, we observe 16 correct responses of "more A" and 32 incorrect responses of "more A'" (Table 20; recall that $A \supset A'$ - see p.10 above).

With this assumption, the rest of the data fall into place. For the class of flowers, the assumption that A and A' have been confused requires amendment of the inclusion questions: we must now regard $A'(B$ questions as being, in effect for the child, $A(B$ questions; likewise $A(B$ questions must now be regarded as, in effect, $A'(B$ questions. When we now consider the appropriate data in the light of these revisions, we find:

- (i) $A(B$ comparisons (63% correct, Table 20) be regarded as in effect $A'(B$ comparisons, with a success rate of 63%;
- (ii) $A'(B$ comparisons (25% correct, Table 20) be regarded as in effect $A(B$ comparisons, with a success rate of 25%.

These data compare with the results for classes of animals and children, where $A'(B$ comparisons are 66% correct, and $A(B$ comparisons are 13% correct (Table 20).

Thus the results on inclusion questions presented against the class of flowers show an inverse relation with those presented against classes of children and animals; but this inverse relation is corrected with the assumption that the subclass-names (A and A') of the class of flowers have been confused. This assumption is checked in Experiment 9.

Experiment 9

It has been suggested that the inverted pattern of results previously obtained with the class of flowers arose as a result of confusing the referents of the subclass-names, tulips being associated with the name "daffodils", and daffodils associated with the name "tulips". It is a consequence of this view that had the referents of these subclass-names not been confused, the response pattern would not have been inverted. This can be tested simply by clarifying the referents of the subclasses of flowers, referring to them not as "tulips" and "daffodils", but as "red flowers" and "yellow flowers" respectively. If our interpretation is correct, we now expect that the response pattern with the class of flowers will re-invert, and conform to the response pattern previously observed with the classes of animals and children.

Subjects The subjects of Experiments 7 and 8, tested up to two weeks later.³²

Material Card (i): 4 red tulips and 2 yellow daffodils, and Card (iv): 2 red tulips and 4 yellow daffodils, of Experiments 7 and 8.

Procedure Since subjects were familiar with the general procedure, they were now simply shown a card and presented with the question: "Are there more flowers or more red flowers?" (care was taken to ensure that subjects could distinguish red from yellow). Presentation of the question in this form, compared with: "Are there more flowers or more tulips", clarifies the referent of the subclass, for the child no longer has to remember whether "tulips" refers to the red or the yellow flowers - the question does this for him.

The inclusion question: "Are there more flowers or more red flowers" functions as a $A \setminus B$ question for Card (i) (4 red tulips), and as a $A' \setminus B$ question for Card (iv) (2 red tulips).

The cards were presented twice to each subject in random order.

Results Responses (both correct and incorrect) appear in Table 21:

Table 21: Comparison responses (Experiment 9)

Comparison	Total responses	Response			Correct responses
		<u>B</u>	<u>A</u>	<u>A'</u>	
$A \setminus B$	48	2	42	4	4%*
$A' \setminus B$	48	26	15	7	54%**

* 63% in Experiments 7 and 8 (Table 20)

** 25% in Experiments 7 and 8 (Table 20)

Subjects now fail with A(B comparisons (4% correct) and meet with apparent success in A'(B questions (54% correct). Thus the pattern of responses re-inverts as expected, and is now comparable to that obtained in Experiments 7 and 8 with the classes of animals and children.

Discussion The main findings of these experiments can now be briefly summarized.

Starting from Piaget's report of different results being obtained when inclusion questions were posed of classes of flowers and animals, it has been suggested that such differences are not to be explained in terms of "remoteness from everyday experience", for when A:A', A'(B and A(B comparison questions are posed of familiar material, and nonsense material which is genuinely remote from the experience of experimental subjects, we find no decrement in the performance of a group of 10-year-old children on any type of comparison, while the performance of a younger group of 6-year-old subjects shows a decrement on all three types of comparison question (Experiment 5). This suggests that decrements in performance are not due to the "remoteness" of the experimental material, but rather that such decrements are a function of the difficulty subjects can experience in co-ordinating the names and referents of the comparison question constituents.

That there is a link between the child's ability to name and compare receives some credibility from Experiment 6 which suggests that the child's ability to handle comparison questions is a function of his ability to spontaneously name the constituents of the

experimental material. This latter ability provides an index of the child's familiarity, not with the nature of the experimental material: for he knows that the objects are flowers, or boys and girls, or horses and cows, but with the appropriate class and subclass names of the material. I.e. spontaneous naming of the material constituents either by class or by subclass implies differential familiarity with class- and subclass-names. And it is this differential familiarity with the names of constituent terms in comparison questions which appears to (at least partially) underlie the child's differential success in answering such comparison questions.

In an attempt to uncover the processes which might underlie the child's responses via more intensive study of a smaller group of younger subjects, the data of Experiment 7 suggest that when the child spontaneously names sets of objects (e.g. animals and children) with the appropriate subclass-names, the child's pattern of responses conforms to that previously reported in the literature: the child meets with success in comparing subclasses ($A:A'$), apparent success in comparing class and minor subclass ($A'(B)$), but failure in comparing class and major subclass ($A(B)$). However with another set of objects (flowers), where the child's spontaneous naming behaviour indicates an inability to produce appropriate subclass-names, the pattern of responses is inverted: failure with $A:A'$, failure with $A'(B)$, but apparent success with $A(B)$ comparisons.

These patterns of response remain stable when replicated with another group of subjects (Experiment 8).

It appears that these results are explicable given the assumption that the child's unfamiliarity with the subclass-names of the class of flowers has led to confusion of their referents: A-objects have been associated with A'-name, A'-objects with A-name. This will account for the child's failure with A:A' comparisons, his failure with A'⊂B comparisons (which, given the character of the confusion, are, for the child, in effect A⊂B comparisons), and his apparent success with A⊂B comparisons (in effect, A'⊂B comparisons).

The notion that this inverted pattern of results with the class of flowers in Experiments 7 and 8 arose as a function of the confusion of subclass-names and referents is tested in Experiment 9, where on presentation of A'⊂B and A⊂B inclusion questions, the referents of the subclasses are made appropriately clear in the form of the question presented to the child. The pattern of responses now re-inverts, data now conforming to the pattern previously established with classes of animals and children.

In summary then, these experiments suggest that semantic aspects of the task play a considerably greater role in the problem of class inclusion than has been previously recognised. However in addition to this general conclusion, the results of Experiments 7, 8 and 9 provide us with hypotheses for further investigation, for they indicate some interesting features of inclusion questions in the event that the referents of the subclasses are unclear. This suggests that we pursue inquiry into the problem of the clarity of reference of terms in inclusion questions, and how this problem might relate to the processes which Piaget postulates as underlying

erroneous responses to such inclusion questions. Therefore let us first briefly recall Piaget's account of processes underlying $A' \subset B$ and $A \subset B$ comparisons, and then, in the light of our present results, propose a number of amendments.

$A' \subset B$: comparison of class and minor subclass

We have seen that for Piaget, the child's success with this type of comparison is more apparent than real: the child in fact compares the two subclasses (A and A'), finds A to be the greater, and then "simply calls" A by the class term B, thus yielding an apparently correct result.

$A \subset B$: comparison of class and major subclass

Again Piaget argues that the child compares A with A' , finding A to be the greater ("more A"). However the child now produces just this response, for now A is not "simply called" by the class term B, as in the previous comparison.

Clearly, both these processes rest on the assumption that the child cannot compare a class with one of its parts: the child's reduction of such inclusion questions to subclass-subclass comparisons is therefore regarded as inevitable.

Now consider some alternative proposals. First, suppose that the child does indeed compare subclasses on both types of inclusion question, but that this is not inevitable - i.e. this process of reduction to comparison of subclasses does not arise from the child's inability to compare a class with one of its parts, but rather from

the child's interpretation of the inclusion questions. For assume that the child interprets inclusion questions as follows.

Consider an array of 4 tulips and 2 daffodils, and the inclusion questions:

- (1) A'(B: Are there more daffodils (A') or more flowers (B)?
- (2) A(B: Are there more tulips (A) or more flowers (B)?

For these questions, suppose that the child interprets the class term B (flowers) as referring to that subclass which contrasts with that specified in the inclusion question. Thus we suppose that in question (1), where the subclass specified in the question is daffodils (A'), the class term flowers (B - the remaining term in the question) is interpreted by the child as referring to the remaining subclass - i.e. to the tulips (A). And with question (2), where the specified subclass is tulips (A), we suppose that the child interprets the class term flowers (B - the remaining term in the question) as referring to the remaining subclass - i.e. to the daffodils (A').

For convenience, the following short-hand notation can be employed. When a term is spoken^u by E or S, this will be enclosed with quotation marks - thus: "A" represents the utterance of the term-A, "B" represents the utterance of the term-B, etc. By comparison, when such terms are not enclosed in quotes, this will indicate that the objects themselves are intended - thus: A represents the A-objects, B the B-objects, etc. Thus the distinction between the A-term and the A-objects will simply be represented by "A" and A respectively, etc.

Summarising our proposals then: the child interprets inclusion questions as follows:

in question (1): "Are there more daffodils or more flowers" ("A' \ B"), the child interprets "A'" ("daffodils") as referring to A' (daffodils), and the remaining term "B" ("flowers") as referring to the remaining subclass A (tulips);

in question (2): "Are there more tulips or more flowers" ("A \ B"), the child interprets "A" as referring to A, and the remaining term "B" ("flowers") as referring to the remaining subclass A' (daffodils).

Thus we suppose, with Piaget, that inclusion questions do involve reduction to subclass-subclass comparisons, but not via an inability to compare class and subclass, but rather through the child's interpretation of inclusion questions, where "B" is restricted to A in minority inclusion questions (like (1)), but to A' in majority inclusion questions (like (2)).

The former assumption - that the child can compare class and subclass, is based on consideration of responses to "subtraction questions" (p. 17 above) which suggest that the child does possess this ability; and the latter assumption - that the child restricts the reference of "B" in inclusion questions, is based (i) on consideration of the response patterns in Experiments 7, 8 and 9 and (ii) on consideration of a recent study of semantic development. Consider these latter points in turn.

(i) When we present "A' \ B" inclusion questions, we customarily obtain the response "B" (animals and children material, Experiments

7 and 8; flower material, Experiment 9); however should the child confuse "A'" with A, we do not obtain this response "B" (flower material, Experiments 7 and 8). Likewise, when we present "A(B" questions, we customarily fail to obtain response "B" (animals and children, Experiments 7 and 8; flowers, Experiment 9), unless the child has confused "A" with A' when we do obtain response "B" (flowers, Experiments 7 and 8).

Now if the above assumptions are correct, this is precisely what would be expected. For in "A'(B" questions, if "A'" is taken as referring to A, the remaining term in the question "B" will be taken as referring to the remaining subclass A'. Since subclass A is greater, and since the child is referring to this subclass by "A'", this is the response that is produced (Table 20). Similarly in "A(B" questions, when "A" is interpreted as referring to A', the remaining term "B" will be taken as referring to the remaining subclass A; and again, since A is the greater subclass, and since the child is referring to it by "B", this is the response that is produced (Table 20).

Thus these assumptions seem able to accommodate the patterns of response observed in Experiments 7 through 9. Let us now turn to discussion of their general features.

First, by envisaging an identical process - of differential restriction of the reference of the term "B" - underlying both types of inclusion question, our assumptions attempt to resolve the inconsistency between such processes in Piaget's account.

Second, our assumptions envisage short-term switches in reference of term "B": from A in minority questions to A' in majority inclusion

questions. It is conceivable, by analogy, that in a different context of question - e.g. subtraction questions, that we obtain yet a further switch in reference of "B", which is now apparently interpreted as referring to both A and A'. If this should be so, the anomaly in Piaget's account between results obtained in different contexts of question will be reduced.³³

Therefore these assumptions are clearly of some interest, for they counteract two features of Piaget's account which appear unsatisfactory: the inconsistency in processes held to underlie erroneous responses to different types of inclusion problem (majority and minority inclusion questions); and the anomaly between the child's performance in different contexts of question (inclusion and subtraction questions). If our assumptions can be justified, the similar process they envisage underlying both types of inclusion question is not subject to the criticism of inconsistency; and the short-term switches in reference of the term "B" envisaged both between majority and minority inclusion questions, and between these and subtraction questions, do not lead to anomaly.

Clearly the central assumption concerns differential restriction in the reference, or applicability, of the superordinate term "B", and we must now ask if there is any evidence that this in fact occurs. This brings us to a recent study of semantic development.

(ii) Study of the young child's acquisition of adjectives which describe variations in size (e.g. big, tall, thick, wide, etc.) leads Campbell & Wales (1970) to the following suggestion:

(Initially, big) is used with reference to almost all differences of size. As the other more specialized adjectives are learned, however, big may fall out of use or may be restricted to cases of complex differences in size (e.g. to cases where the objects being compared covary along two or more dimensions).

(Campbell & Wales, 1970: 259)

Thus whereas all differences in size (tall, thick, fat, wide, etc.) are initially described via use of big, as the child acquires the more specialized adjectives, use of big decreases, being used only in cases of complex size differences.

By analogy with this process of initial use of an all-encompassing superordinate adjective being progressively restricted through acquisition of more specialized hyponyms (Lyons, 1968: 453-455), Campbell & Wales go on to suggest that a similar process may underlie the child's response to Piaget's inclusion questions:

For instance, show the child three tulips and five roses and then ask: "Are there more roses or more flowers?". At lower age-levels children tend to reply that there are more roses. If children typically organise their vocabulary in the way we have suggested then this result is hardly surprising.

(Campbell & Wales, 1970: 259)

Thus Campbell & Wales envisage that, initially, the child acquires correct application of the all-encompassing superordinate term

flowers. Use of this term (like big) is then progressively restricted as the hyponyms (e.g. rose, tulip, daffodil etc.) are acquired (like tall, fat, thick, wide, etc.). Thus the child's response: "More roses", to the inclusion question: "Are there more roses or more flowers" is interpreted as due to the fact that the child has, for the roses, restricted application of the term flowers. The "inclusion" question effectively asks the child to compare the roses and the (remaining) flowers - i.e. the tulips.

Now of course there are similarities between the account of inclusion questions which we have presented above, and that of Campbell & Wales; however it is useful to stress the differences. While Campbell & Wales envisage the process of restricting applicability of the superordinate as hyponyms are acquired, it is clear that this is seen as a long-term process. However in the account being presented here, it is suggested that the process is essentially short-term (i.e. dependent on immediate context). Consider the inclusion question discussed by Campbell & Wales: whereas the reference of "flowers" is interpreted as applying to tulips in the "more roses or more flowers" question, we know that on presentation of a "more tulips or more flowers" question, the child's interpretation of the reference of "flowers" will immediately switch to roses. So while Campbell & Wales appear correct insofar as the processing of A(B) questions is concerned: the child does indeed appear to restrict use of "B" to the subclass of tulips (A'), their suggestion as to the long-term nature of such restrictions appears less satisfactory: there seems ample evidence in Experiments 7 through 9 to suggest that such restrictions are essentially short-term.³⁴

Since, as already suggested, restrictions in reference of superordinate terms will accommodate both the inconsistency and anomaly apparent in Piaget's account of inclusion, and since there is some evidence that such a process of restriction does occur in semantic development, the next step must be to obtain some evidence which will reflect not only on the incidence of referential restrictions of the superordinate class term in inclusion questions, but also on their short-, or long-term nature. We attempt to obtain such evidence in the following experiment.

Experiment 10

This experiment intends to test the incidence (if any) of short-term switches in the reference of the class term "B" by presenting $A \subset B$ and $A' \subset B$ inclusion questions in the standard manner, and then asking the child to indicate the referents of the terms in the question he has just answered.

Predictions are as follows (cf: p. 107 above):

(1): for $A \subset B$ questions it is predicted that "B" will be interpreted as applying to subclass A' (i.e. "B" = A').

(2): for $A' \subset B$ questions it is predicted that the reference of "B" will switch and now be interpreted as applying to subclass A (i.e. "B" = A).

A third condition will also be observed, where the child is presented with an instruction involving use of "B" without specific mention of either major or minor subclass. For such instructions we predict:

(3): a further referential switch in that the child will now interpret "B" as applying to both subclasses (i.e. "B" = $A + A'$).

Subjects 12 naturally English speaking schoolchildren (6 male) of mean age 5;5 years (range: 5;4 - 5;6).

Material Cards (i) - (iii) of Experiment 6, showing classes of animals (4 horses + 2 cows), children (4 boys + 2 girls) and flowers (4 red tulips + 2 yellow daffodils).

Each member of each of these classes, individually mounted on cardboard squares (approximately 1 x 1").

Three cards (9 x 9"), one red, one black, one grey.

Three wooden boxes (8 x 7 x 1½").

Procedure Subjects were tested individually by the same E. Ss were informed that E had some games which they were going to play. The classes of objects were introduced by showing Cards (i) - (iii) and asking S to name the material as in previous experiments. The subclasses of flowers were referred to as "red/yellow flowers" rather than "tulips/daffodils".

The coloured (9 x 9") cards were then placed on the table between S and E, the red card in the centre, the grey card to S's left, and the black card to S's right.

A class of material (on separate 1 x 1" squares) was then placed on the table in front of S, who was asked to reidentify them: consider the class of children as example:

You have seen these before. What are these (pointing to A)? -

Boys. Yes, that's right. And what are these (pointing to A')? -

Girls. Yes, these are girls. And what do we call them, what are boys and girls? - Children. Yes, that's right, boys and girls are children.

Let's put them on the red card.

When this had been done, S was then instructed:

You put the children ("B") on the black card(R1)

When S's response had been noted, E returned the material which S had moved to the centre red card.

Thereafter, one of the two standard inclusion questions was presented: "Tell me, are there more children or more girls (A'(B)?" When S had given a reply, he was then instructed:

Put the children ("B") on the black card, and the girls (A') on the grey card.(R2)

Alternatively: "Tell me, are there more children or more boys (A(B)?" After S had given a reply, he was instructed:

Put the children ("B") on the black card and the boys (A) on the grey card.(R3)

The order of presentation of these two inclusion questions was counterbalanced across the group, as were the order of terms in the questions ("more A/A' or more B" versus "more B or more A/A'"), and the order of terms in the subsequent instructions ("put the B on the black card and the A/A' on the grey card" versus "put the A/A' on the grey card and the B on the black card").

After S had replied to an inclusion question and made a response to the appropriate subsequent instruction, E placed the material which S had moved back to the centre red card, presented the other inclusion question and instruction, and again returned the material to the centre red card.

E then placed a wooden box on the table, and instructed S:

You put the children ("B") in this box.(R4)

E noted S's behaviour in placing material on the black card on the occasions R1-R3, and into the box on R4.

If the above predictions are upheld, for each class of objects S should place material as follows:

(R1) S should place all the material on the black card, indicating his interpretation of "B" as referring to both A and A' ("B" = A+A' - see prediction (3) above).

(R2) S should place the A material on the black card, indicating a switch in reference where "B" is now interpreted as restricted to A ("B" = A in A'⊂B inclusion questions - see prediction (2) above).

(R3) S should place the A' material on the black card, indicating a further switch in reference of "B", now restricted to A' ("B" = A' in A'⊂B inclusion questions - see prediction (1) above).

(R4) S should place all the material in the box, indicating yet another switch in reference of "B", now taken as referring to both subclasses ("B" = A+A' - see prediction (3) above).

Results Data appear in Table 22, where entries represent the number of subjects (maximum: 12) whose behaviour in placing material on occasions R1 through R4 conforms to that predicted:

Table 22: /

Table 22: Number of subjects who respond as predicted (Experiment 10)

Material	Occasion			
	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>
children	10	12	12	9
animals	8	10	11	8
flowers	10	12	12	12
Totals	28	34	35	29
Percentage totals	78%	94%	97%	81%

The patterns of observed data clearly indicate that subjects' interpretations of the referents of "B" switch at different points in the experiment, in the manner predicted.

Discussion On the whole, the results of this experiment seem reasonably clear, for subjects' interpretation of the reference of "B" for instructions R1 through R4 seems dependent on whether or not the instruction has been immediately preceded by specific mention of a subclass. Thus for R2, immediately preceded by A'(B questions which specify minor subclass A', subjects clearly interpret "B" as applicable to major subclass A (94% of observations), while for R3, immediately preceded by A(B questions specifying major subclass A, subjects now interpret "B" as referring to minor subclass A' (97% of observations) - see Table 22. Thus short-term switches in the reference of "B" between these occasions are observed as predicted.

However the results for R1 and R4 are perhaps not quite so clear, although on the whole they do conform to the expectations that when instructions involving mention of "B" are not immediately preceded by mention of subclasses, there will be no restriction in the reference of the B term: for R1, 78% of observations conform to the prediction that "B" will encompass both subclasses (A+A'), while the analogous figure for R4 is 81% (Table 22).

However an interesting feature of these results lies in the considerable proportion of observations which fail to conform to expectation - 22% of observations in R1, and 19% in R4, where subjects appear to restrict the reference of "B" to one or other of the subclasses in a "spontaneous" fashion. This process of "spontaneous restriction" does not seem accommodated by the suggestion that restrictions of "B" are induced by specification of contrastive subclasses (p. 106 above). A more detailed breakdown of the data for R1 and R4 appears in Table 23, which shows that in 12% of observations, reference of "B" appears spontaneously restricted to major subclass A (11% for R1, 14% for R4), and that in 8% of observations, reference of "B" is spontaneously restricted to minor subclass A' (11% for R1, 5% for R4).

Table 23:/

Table 23: Referents of "B" for instructions R1 and R4 (Experiment 10)

Material	Referents of "B"					
	R1			R4		
	<u>A+A'</u>	<u>A</u>	<u>A'</u>	<u>A+A'</u>	<u>A</u>	<u>A'</u>
children	10	2	0	9	3	0
animals	8	1	3	8	2	2
flowers	10	1	1	12	0	0
Totals	28	4	4	29	5	2
Percentage totals	78%	11%	11%	81%	14%	5%

Of course these results might be attributed to experimental noise, except that the apparent lack of noise in the data for R2 and R3 makes this seem less plausible.

Further consideration of subjects' responses to R1 and R4 is informative; most subjects, when presented with the instruction: "You put the B on the black card/in the box" immediately moved the A and A' subclasses on to the card/into the box. However some subjects moved one of the subclasses and then appeared rather hesitant before moving the other subclass. One subject expressed his doubts quite explicitly for R1, asking E: "Do you want me to put all the B on the black card?".

As we can see from Table 23, some subjects simply moved one of the subclasses and left aside the other subclass (8/36 observations

for R1, 7/36 observations for R4). When this occurred, E asked the following supplementary question - consider the class of animals (horses and cows) with respect to R1 as example:

assume that on the instruction to put the animals on the black card, S moved only the horses, leaving the cows on the centre red card; E would then ask: "What about these (pointing to the cows) - aren't these animals too?" (and so as appropriate to the class of material and the child's behaviour). The responses to this type of question are interesting: in some cases children made no further response, neither saying anything nor moving any material. In one case, the child gave an explicit answer: "No, these (the cows) aren't animals", whereupon E then asked: "Well if they're not animals, what are they?", to receive the response: "They're cows". Now this would look very much like the sort of long-term restriction discussed above (p. 111), except for the fact that the child has just previously agreed, when the material was set out on the table, that both horses and cows are animals.

An equally common response to E's supplementary question was where S replied: "Oh yes, they are animals too", and then moved the subclass in question from the centre red card to join the subclass which had already been moved to the black card. This sort of response occurred in 5 out of 8 cases for R1, and in 2 out of 7 cases for R4.

Thus it appears that with the B term, even without mention of a contrastive subclass, some subjects spontaneously restrict application of "B" to one or other of the subclasses, while the spontaneous restrictions of other subjects seem little more than a

result of uncertainty which is overcome on presentation of a supplementary question sufficient to clarify the application of "B".

Since the notion that "B" terms may be restricted as a result of uncertainty as to their application is of considerable interest, it was decided to examine this further by presenting the same subjects with "subtraction questions" (p. 17 above) in order to observe whether this process of spontaneous restriction of "B" occurs: (i) with a different context of questions; (ii) when such questions are manipulated for clarity of reference.

Experiment 11

Subjects The subjects of Experiment 10, tested up to 4 days later.

Material The 9 x 9" red card, and the classes of material individually mounted on 1 x 1" cardboard squares, of Experiment 10.

Procedure Subjects were introduced to the task with the preamble of Experiment 10 (see p. 114 above), and the same reidentification procedure was employed ("You have seen these before, etc..... Let's put them on this red card").

The following subtraction questions were then presented, order of presentation being counterbalanced across subjects except for question (4) which was always presented last:

- (1) If I took the A away from this card, would there be anything left?
- (2) (This time) If I took the A' away, would there be anything left?
- (3) (This time) If I took the B away, would there be anything left?
- (4) (This time) If I took all the B away, would there be anything left?

Subjects responses were recorded.

Results The results for questions (1) and (2) are clear - subjects uniformly reply that the A' will be left in question (1), and that the A will be left in question (2). (Occasional misunderstandings did occur: for example - "If I take the boys away, will there be anything left? - Yes, the girls. This time, if I take the girls away, will there be anything left? - No. Why not? - Because you've taken them all away. What have I taken away? - These (pointing to the boys and girls). All right, suppose I haven't taken anything away yet. Now this time, if I take the girls away, will there be anything left? - Yes, the boys". Clearly this sort of misunderstanding arose when the child did not appreciate that the intended "starting point" for each subtraction was the total class. When this was made clear, subjects invariably handled questions (1) and (2) correctly.)

Results for questions (3) and (4) appear in Table 24, where entries represent the number of subjects (maximum: 12) who say that subclass A, subclass A', or nothing (0) will be left on subtraction of "the B" ("-B": question (3)), and on subtraction of "all the B" ("-all B": question (4)):

Table 24: Remaining material on subtraction of B or all B (Experiment 11)

Material	Question					
	(3): -B			(4): -all B		
	<u>A</u>	<u>A'</u>	<u>0</u>	<u>A</u>	<u>A'</u>	<u>0</u>
children	3	3	6	0	0	12
animals	2	5	5	0	0	12
flowers	2	5	7	0	0	12
Total	7	11	18	0	0	36
Percentage total	19%	31%	50%	0%	0%	100%

Note To obtain the appropriate restrictions, we simply invert. E.g. consider responses to Question (3) in Table 24. If 7 subjects (Column 1) say that on subtraction of "B", A will remain, then clearly these subjects are restricting "B" to A'. Analogously, if 11 subjects (Column 2) say that on subtraction of "B", A' will remain, then clearly these subjects are restricting "B" to A. Taking a specific example: if there are tulips (A) and daffodils (A') on the board, and if S says that the tulips (A) will be left on removal of the flowers (-B), then the subject is restricting flowers ("B") to the daffodils (A'); but, if S says that the daffodils (A') will remain on removal of the flowers (-B), then S is restricting "B" to the tulips (A).

Discussion These results indicate that in a different context of question than that presented in Experiment 10, we can again observe some spontaneous restriction of "B" to one or other subclass; although on 50% of observations there is no such restriction, on 31% of observations "B" is restricted to A and on 19% of observations "B" is restricted to A' (Table 24; see the above Note on inversion).

However these results are quite clearly a function of uncertainty as to the application of "B" in question (3), for when the application of "B" is clarified in question (4): "If I take away all the B ...", subjects uniformly reply that there will be nothing left. The differences in response to these questions are significant (for the class of children: $z = 2.45$, $p < .05$; animals: $z = 2.65$, $p < .05$; flowers: $z = 2.24$, $p < .05$).

Thus the process of restriction of the "B" term would appear to be not only a function of specification of a contrastive subclass, for "B" also appears at times spontaneously restricted when its application or reference is unclear; however when its reference is clarified, such restriction disappears.

These results are of interest in that they have a direct bearing on the anomaly in Piaget's account of inclusion: when Piaget presents subtraction questions the child appears to appreciate the relations holding between a class and its constituent parts: i.e. that $B = A + A'$ and that $B - A' = A / B - A = A'$. However the child appears unable to handle these relations on presentation of inclusion questions. As already mentioned (p. 19 above) Piaget attempts to account for this anomaly by suggesting that in the latter context of inclusion questions, the child is unable to co-ordinate the relations of the former context of subtraction questions. We are now in a position to offer an alternative hypothesis.

First consider Piaget's data (Inhelder & Piaget, 1964: 109, Tables IV and V): while twenty subjects of 5-6 years produce a 46% success rate with the inclusion question: "Are there more flowers or more primulas" (Table IV), the success rate increases to 71% with subtraction questions (Table V).

The present results with subtraction questions show 50% success with question (3): subtraction of "the B", but 100% success with question (4): subtraction of "all the B".

Now consider the form of Piaget's subtraction question: "If all the flowers are picked, are any primulas left?". Thus Piaget's

question, like question (4) above, includes the phrase "all the Bs", which presumably clarifies the reference of the "B" term, leading to a considerably higher rate of success than might be obtained with an analogue to question (3) above: "If the flowers are picked, are any primulas left?".

Thus the anomaly in Piaget's data may be due to the fact that in one context of questions (subtraction) the reference of "B" is clarified - yielding a large measure of success, but unclarified in the other context of questions (inclusion) where considerable lack of success is generally observed. On this assumption, should the reference of "B" be as unclarified in the context of subtraction questions as is the case with inclusion questions, a considerable decrease in the success rate might be expected. And this is exactly what is observed in the results of Experiment 11 (Table 24).

This yields an interesting hypothesis: namely, that the child's lack of success with inclusion questions is not a function of an inability to simultaneously co-ordinate comparison of a whole class with one of its parts, as in Piaget's account, but rather a function of the language associated with the inclusion questions presented to the child. For consider the argument to date: the reference of "B" seems unclear in inclusion questions ($A(B)$) which subjects generally fail to answer correctly; when the reference of "B" is similarly unclear in subtraction questions ($-B$), we obtain a similar failure rate. However when the reference of the "B" term is clarified in subtraction questions ($-all\ B$), the success rate increases significantly (Piaget's own results; Experiment 11 above). The next step is now clear: if inclusion questions are presented with

the reference of "B" clarified (e.g. A(all B), will we obtain an increase in success as is the case with subtraction questions?

If so, the anomaly in Piaget's account will dissolve. This notion is tested in the following set of experiments.

Experiment 12

At this point we encounter a methodological difficulty, although our problem seems straightforward enough: we wish to present what can be called "standard" class inclusion questions of the sort used by Piaget (i.e. $A(B)$), and compare performance with that obtained on presentation of "amended" class inclusion questions where the reference of the "B" term is clarified in some way (e.g. $A(\text{all } B)$). But clearly, subjects must respond incorrectly to standard CI questions before we can draw any conclusion from differences in performance (if any obtain) with amended CI questions: for our hypothesis is that incorrect answers to standard questions are not so much a function of inability to simultaneously compare a class and subclass, but rather a function of the language of the standard questions. If a child answers standard questions correctly, in Piagetian terms he is already functioning in an operational manner, and is thereby unsuitable as a subject for the present experiment.

The most obvious means of ensuring that subjects are not operational is to work with children considerably younger than 8 years (when subjects customarily pass from the preoperational stage). Thus the following experiments observe children of 5-6 years, most of whom can be expected to answer standard CI questions incorrectly.

However this does not meet the difficulty completely, for it is a commonplace of developmental theories that one may not identify age with stage; thus there is no guarantee that all 6 year-olds will be preoperational and answer standard CI questions incorrectly. Indeed, we have seen Piaget report that 46% of 5-6 year-olds answer his (standard) questions correctly (Inhelder & Piaget, 1964: 109; see p. 125 above).

Previous studies underline this difficulty - in a study by Morf (1959), as reported by Kohnstamm (1963), 27% of subjects aged 4-7 years answered standard inclusion questions correctly in a spontaneous fashion. However in Kohnstamm's own studies, only 3% of 5 year-olds gave spontaneously correct answers.

These differences in the proportions of subjects who answer standard CI questions in a spontaneously correct manner can presumably be attributed to sampling and/or material. Nevertheless this does suggest that in any group of 5-6 year-olds, there are likely to be some children who will answer standard CI questions correctly from the outset. Thus in the present experiment, and in those that follow, we attempt to incorporate a check which will identify that proportion of the group which answers standard questions in a spontaneously correct manner, and base any conclusions on data from the proportion of the group that remains. Thus any differences that may obtain between performance on standard and amended CI questions will be confined to subjects who answer the former questions incorrectly.

Subjects 24 naturally English speaking schoolchildren (14 male), of mean age 5;8 years (range: 5;6 - 5;11).

Material As for Experiment 11 (p. 122 above).

Procedure A class of material, mounted on individual 1 x 1" squares, was placed on the red card on the table. The customary naming procedure was effected.

E then presented a standard CI question (A(B) in the form: "I want you to tell me which there are more of: are there more of the A or more of the B?". S's response was recorded, the material removed, the next class of material presented, the naming procedure effected, and a further standard inclusion question put to the child. This continued until S had made a response to standard CI questions presented against all three classes of material (children, animals, flowers), order of presentation of classes being counterbalanced across the group, as was order of terms within the questions: "more of the A or more of the B" versus "more of the B or more of the A".

When a child had completed this part of the experiment, the material was presented again, but now the child was asked amended CI questions of the form: "Are there more of the A or more of all the B?", or: "Are there more of the A or more of the B altogether?", or: "Are there more of the A or more of all the B altogether?", these forms of question being intended to clarify the reference of the "B" term. Presentation of material and order of terms in the questions were counterbalanced as before.

Results For each subject we have three responses on a set of standard CI questions, and three responses on a set of amended CI questions, presented against the same material. Where a subject has given two or three consistent responses in any set, that consistent response has been recorded as his answer for that set. For example, if a subject answered "more boys" (A), "more animals" (B), and "more red flowers" (A), to a set of three questions, whether standard or amended, then his overall consistent response has been recorded as A. However had this subject answered "more children" (B) to the first question, his consistent response (2 out of 3) would have been recorded as B.

Of the 24 subjects tested, 8 answered B to at least two of the standard CI questions; we therefore regarded these subjects as having answered the standard questions in a spontaneously correct manner, and did not test them further.

Of the remaining 16 subjects, who had answered A to at least two standard questions, 5 then answered the amended CI questions correctly while the other 11 subjects answered the amended questions incorrectly. Thus of 16 subjects amenable to facilitation in answering CI questions when the reference of the "B" term is clarified, 5 are in fact facilitated, but 11 are not.

These results, summarised in Table 25 where entries represent number of subjects, are somewhat unexpected:

Table 25:/

Table 25: Results (Experiment 12)

CI question form	Responses		
	<u>Total</u>	<u>Correct</u>	<u>Incorrect</u>
Standard	24	8	16
Amended	16	5	11

However, while we might be tempted to reject our hypothesis had none of our subjects shown facilitation, the fact that five subjects do show facilitation suggests that the hypothesis be regarded as "not proven" - i.e. there is not at present sufficient evidence in its support.

The hypothesis is therefore tested further in the following experiment where we attempt to ensure that all subjects are aware of the reference of the term "all the B". Although it was assumed in Experiment 12 that this would be so from the form of the amended CI question, this assumption may not in fact have been met. Thus subjects showing lack of facilitation on a question like: "Are there more of the A or more of all the B" may still be restricting the term "all the B" to the contrastive subclass A', as in previous experiments. In the experiment which follows we therefore interpose, after presentation of standard CI questions, but before presentation of amended CI questions, the set of subtraction questions utilized in Experiment 11 (p. 122 above), where the difference between question (3): "-the B" and question (4): " -all the B" is intended to clarify the reference of the latter phrase in the subsequently presented amended CI questions.

Experiment 13

Subjects 24 naturally English speaking schoolchildren (12 male) of mean age 6;5 years (range: 6;0 - 6;8).

Material As for Experiment 12.

Procedure The customary naming procedure was effected for a class of material placed on the red card. A standard inclusion question (A<B: "Are there more of the A or more of the B") was then presented.

When S had given a response, subtraction questions (1) - (4) (p. ¹²² above) of Experiment 11 were presented, in that order, in an attempt to emphasize the reference of the phrase "all the B".

An amended question (A<all B: "Are there more of the A or more of all the B") was then presented.

This procedure was repeated for the other two classes of material, orders of presentation of classes and terms in the inclusion questions being counterbalanced as before.

Results Data are treated as in Experiment 12 - the subject's consistent response to two or three out of three standard, or amended, CI questions is recorded.

Of the 24 subjects tested, 6 gave spontaneously correct answers to at least two of the initial set of standard CI questions and were therefore not tested further. The remaining 18 subjects may be regarded as amenable to facilitation.

With the subtraction questions, results are similar to those obtained in Experiment 11 - while answers are generally correct to questions (1) and (2) ("A" and "-A" respectively), there is a considerable amount of restriction with question (3) ("-B"), which again disappears with question (4) ("-all B"). Data for these last two questions appear in Table 26, where the maximum number of observations per entry equals 54 (18 subjects x 3 classes of material). Observations concern what subjects say will be left (A, A' or nothing) on subtraction of "the B" (question (3)), and on subtraction of "all the B" (question (4)); as before, restriction may be gauged by inversion (see Note p. 124 above).

Table 26: Remaining material on subtraction of "B" or "all B"
(Experiment 13)

Material	Question					
	(3): -B			(4): -all B		
	<u>A</u>	<u>A'</u>	<u>0</u>	<u>A</u>	<u>A'</u>	<u>0</u>
children)) animals)) flowers)	32	3	19	0	0	54
Percentage totals	59%	6%	35%	0%	0%	100%

Direct comparison between Tables 24 and 26 is of course misleading, since the former includes data contributed by subjects who might well have given spontaneously correct responses to standard

CI questions, while the latter does not. Nevertheless as before, we notice that restriction of the term "B" to A or A' disappears when the reference of "B" is clarified in question (4).

With the amended CI questions (A(all B)), we find that of 18 subjects amenable to facilitation, 3 are facilitated and 15 are not. These results are summarized in Table 27 whose entries represent number of subjects:

Table 27: Results (Experiment 13)

CI question form	Responses		
	<u>Total</u>	<u>Correct</u>	<u>Incorrect</u>
Standard	24	6	18
Amended	18	3	15

As with Experiment 12, results are somewhat unexpected: attempted clarification of the "B" term in inclusion questions has resulted in the facilitation of but a few subjects. This result naturally leads to the question as to why so many subjects have shown lack of facilitation, quite apart from the obvious factor that but little training has been given.

It was suggested in Experiment 12 that with amended inclusion questions, the term "all the B" may be restricted to the contrastive subclass as was the term "B" in previous experiments. (Should this process in fact underlie the majority of responses in Experiment 12, this is clearly not overcome by attempted clarification of these terms in the context of subtraction questions interposed in the present experiment).

Some plausibility that this in fact occurs comes from consideration of transcribed tape-recordings of responses to a series of supplementary questions presented to the last six subjects of the present experiment, none of whom showed any facilitation. When the experiment proper had been completed, in an attempt to uncover the processes underlying lack of facilitation, E presented an unstandardized set of supplementary questions with respect to that class of material which S had first encountered in the experiment proper. Dialogue between S and E was tape-recorded, and E made appropriate notes of S's pointing behaviour.

Protocols for these 6 Ss read as follows (because of the counter-balanced order of presentation of material, there are two protocols for each class of material):

Protocols: Experiment 13

Array: 6 children, 4 boys and 2 girls

S1 : P.B. female, 6;7 years. "Are there more of all the children or more of the boys? - More of the boys. Show me the boys (- points to the four boys, one at a time; we indicate this with:) bbbb. How many? - Four. Four of the boys. How many of the children? - Six. How many of the boys? - Four. How many of the children? - Six. Which are there more of: more of the boys or more of the children? - More o' the children. Show me the children - bbbbgg. Why are there more of the children? - 'Cos they're all together.'

Notes: This subject appears to answer the inclusion question adequately when the referents of the terms in the question are made clear. However her attempted justification of her response is of the

"inscrutable" variety, at least in Piagetian terms, since there is no explicit recognition that the extension of the major subclass is less than, but contributory to, that of the class.

S2: L.C. female, 6;8 years. "Show me the boys - bbbb. How many? - Four. Show me the children - gg. Show me all the children - bbbbgg. How many? - Six. Six of all the children and how many of the boys? - Four. Are there more of all the children or more of the boys? - Boys. Is six more than four: which is more? - Six. How many of all the children? - Six. How many of the boys? - Four. Which are there more of, more of all the children altogether or more of the boys? - The boys. How many boys are there? - Four. How many of all the children? - Six. Which are there more of? - (no response). If there's six of all the children and four of the boys, which are there more of? - (no response). What do you think? - Six. Six what? - Children. Show me them - bbbbgg."

Notes: This subject clearly restricts the "B" term to the minor subclass A', producing the response "more A" to the A(B question. This response then appears firmly entrenched and is carried over to A(all B inclusion questions. While the supplementary questions above do appear to clarify the reference of "all the B", and while the subject eventually produces the correct answer, there is no guarantee that the subject is now genuinely facilitated, due to absence of justification.

Array: 6 animals, 4 horses and 2 cows

S3: L.B. female, 6;7 years. "Show me all the animals - hhhhcc."

Are there more of all the animals or are there more of the horses?

- All of the horses. Show me the horses - hhhh, counting out loud: one, two, three, four. Four horses. Now you show me all the animals altogether - hhhhcc, counting out loud: one, two, three, four, five, six. All right, four horses and six animals; is that right? - Yes. Which are there more of? - Horses. There are four horses, and how many animals? - Two (pointing: cc). You count them out again, all of the animals - hhhhcc, counting out loud: one, two....six. Six animals, isn't it? - Yes. Which is the bigger number, four or six? - Six. Is six the bigger number? - Yes. All right then, which are there more of: more of all the animals or more of the horses? - Six of them. Six of the what? - Animals. Six of the animals and how many of the horses? - Four. All right, which are there more of: more of the animals or more of the horses? - More of the horses. There are four horses aren't there? - Yes. And how many animals? - Two. How many of all the animals? - Six. Well then if there are six animals and four horses, which are there more of? - All of them. All of the what? - Horscows and horses."³⁶

Notes: This subject clearly restricts "the B" to A', but appears to handle "all the B" correctly. However when an amended CI question is presented, this appears to be reduced, as before, to a comparison of subclasses, which may be due to a confusion between the standard and amended forms of inclusion question. However when this is clarified with further distinction between "the B" and "all the B", an apparently correct response is obtained.

S4: N.S., female, 6;7 years. "Are there more of all the animals or more of the horses? - More of the horses. Show me the horses -

hhhh. How many? - Four. Four horses. Show me the animals - cc.
 Show me all the animals - hhhhcc. How many? - Six. All right,
 six of all the animals, and how many horses? - Four. Four horses;
 and how many of all the animals? - Two. Of all the animals? - Six.
 All right, which are there more of, more of the horses or more of all
 the animals? - More of all the animals. Why? - (no response).
 Show me all the animals - hhhhcc."

Notes: This subject provides explicit evidence for the notion that
 the phrase "all the B" is restricted to A'. When this phrase is
 clarified, a correct response is obtained, although as before, the
 subject gives no verbal justification of her correct response.

Array: 6 flowers, 4 red tulips and 2 yellow daffodils

S5: A.S., male, 6;7 years. "Are there more of all the flowers or
 more of the red flowers? - Red. Show me the red flowers - tttt.
 How many? - Four. Show me all the flowers altogether - ttttdd.
 How many? - Six. All right, four red flowers and six flowers
 altogether; which are there more of: more of the red flowers or more
 of all the flowers? - All of them. Show me all of them - ttttdd."

Notes: This subject responds correctly when the referents of the
 terms in the amended CI question are clarified.

S6: K.L., male, 6;6 years. "Are there more of all the flowers or
 more of the red flowers? - More of the red flowers. Show me the
 red flowers - tttt. How many? - Four. Four red flowers. Show
 me the flowers - dd. Show me all the flowers - ttttdd. How many?
 - Six. Six of all the flowers and how many red flowers? - Four."

And how many of all the flowers? - Six. Which are there more of: more of the red flowers or more of all the flowers? - Red. How many of the red? - Four. How many of all the flowers? - Six. Which are there more of: more of the red flowers or more of all the flowers? - All the flowers. Show me all the flowers - ttttdd. All right, there's more of all the flowers. Can you tell me why there's more of all the flowers? - 'Cos all the flowers are there (indicating array). And how many are there? - Six. And how many red flowers? - Four. Then why are there more of all the flowers? - (no response)."

Notes: This subject also provides evidence that "B" is restricted to A'. When the reference of B is clarified by referring to "all the B", the child eventually produces a correct response to the amended inclusion question. But as with S1 above, the justification obtained is again "inscrutable" according to Piagetian criteria for adequacy of justification.

Discussion These protocols suggest that in subjects initially unfacilitated by an amended form of inclusion question, there is some measure of understanding when the referents of the question terms are clarified by pointing and counting. However the reduction of inclusion questions to subclass-subclass comparison questions often seems entrenched, even when the form of the question is intended to clarify the referents of the superordinate class-term; both standard (A(B) and amended (A(all B) inclusion questions thus often appear treated in a similar manner, "B" or "all B" being restricted to A', the minor subclass.

Now of course Piaget could argue that this is inevitable, given the child's inability to simultaneously compare a class with one of its parts. But as already suggested, the child does seem able to make such comparisons in subtraction questions; the measure of facilitation, however modest, observed in Experiments 12 and 13 above, lends support to this notion, as does the measure of understanding which (initially unfacilitated) subject's indicate on presentation of supplementary questions in the above protocols. Thus the inevitability of the superordinate term being interpreted as referring to the minor subclass in majority inclusion questions seems unacceptable, and leads to the notion that should one be able to prevent inclusion questions being interpreted as subclass-subclass comparison questions, one might expect to observe correct responses. Clearly the problem lies in attempting to achieve this. In the following experiment one such attempt is reported where, for any class of material, we ask subjects to point to all three sets (A, A', all B) and then present the question: "Are there more of the A, more of the A', or more of all the B?". This is intended to prevent interpretation of "B" as referring only to subclass A' (which we have suggested has occurred in previous experiments) by explicitly mentioning subclass A' in the question, to contrast with both B and A.

Experiment 14

Subjects 12 naturally English speaking schoolchildren (5 male) of mean age 6;2 years (range: 6;1 - 6;3).

Material As for Experiment 13.

Procedure A class of material was placed, as before, on the red card in front of S, order of presentation of classes being counterbalanced across the group. The customary naming procedure was effected.

The subject was then asked to point to "the A", "the A'" and "all the B". When this had been done, E asked: "I want you to tell me which there are more of: are there more of the A, more of the A', or more of all the B altogether?" (e.g. "Are there more of the boys, more of the girls, or more of all the children altogether").

Some subjects interrupted and gave a reply before the question had been completed - e.g. "Are there more of the boys, more of the girls, or ..." - "More boys." When this occurred E instructed S: "You are giving me an answer before I have finished asking the question; I want you to wait until I have finished the question before you tell me what you think".

Results Of the 12 subjects tested, 4 responded correctly to all three items, 3 responded correctly to the second and third items

but not to the first, 2 responded correctly to the third item but not to the first or second, and 3 responded incorrectly to all three items. These results are summarised in Table 28:

Table 28: Results (Experiment 14)

Item	Subjects responding correctly	Total
1	4,5,7,11	4
2	4,5,7,11,2,8,10	7
3	4,5,7,11,2,8,10,1,6	9

Discussion There are some difficulties in interpretation of these results. In previous experiments, a subject has been credited with that answer he gives consistently on two or three occasions for a set of three items. Using this method of scoring, 7 subjects out of 12 show facilitation in the present experiment.

However there is no means of estimating how many of these seven would have given spontaneously correct answers to standard CI questions had they been presented. Thus we cannot claim that the present experiment shows a majority of subjects to have been facilitated.

But apart from this, a further difficulty arises - our method of scoring results by recording the predominant response (two or three consistent responses to three items) may well do injustice to those subjects who fail to answer correctly until the third

item (S1 and S6 in Table 28 above), for these subjects may now be responding in a genuinely correct manner. If this should be so, then 9 subjects out of 12 show some measure of facilitation. Presumably this point could be clarified by testing subjects on a longer series of items. However the former difficulty remains - what proportion of subjects would have given spontaneously correct answers to standard CI questions? We attempt to meet these difficulties in the next experiment where subjects are tested on a longer series of items, the first item of this extended series being presented with an inclusion question in standard form in order to "screen" subjects who might answer such questions correctly.

Experiment 15

Subjects 20 naturally English speaking schoolchildren (3 male) of mean age 6;4 years (range: 5;10 - 6;7).

Material Classes of children, animals and flowers, each member being individually mounted on 1 x 1" cardboard squares as in previous experiments; classes of matches, sweets and paperclips. Characteristics are summarized in Table 29:

Table 29: Material (Experiment 15)

Class (B)	Major Subclass (A)	Minor subclass (A')
children	4 boys	2 girls
animals	6 horses	3 cows
flowers	5 red tulips	2 yellow daffodils
matches	4 blue matches	2 red matches
sweets	6 green smarties*	3 white polos**
paperclips	5 wee*** paperclips	2 big paperclips

* A brand name for sugar-coated chocolate buttons

** A brand name for peppermints

*** "wee" is the Scottish dialect variant for the English "small" or "little"

Procedure A class of material was placed on the table before S, order of presentation being counterbalanced across subjects as before. The customary naming procedure was effected.

E then presented an inclusion question in standard form: "Are there more of the A or more of the B (A(B)?)". If S replied: "There's more A", E then attempted to determine the process underlying S's response by asking: "There's more of the A than what?". Consider a protocol by way of illustration:

Array: 7 flowers, 5 red tulips, 2 yellow daffodils

S.M., female, 6;2 years. "Are there more of the red flowers or more of the flowers? - More of the red ones. More of the red ones than what? - Yellow ones."

This sort of response was characteristic: when presented with the standard A(B) question, and after replying "More A", the supplementary question: "There's more A than what" inevitably received the response: "There's more A than A'". This again suggests that subjects in fact reduce standard inclusion questions to comparison of subclasses, restricting "B" to A'.

When it had been determined that S was not answering the (standard) question that had been presented, E then attempted to distinguish the question that was being answered by S (in effect: are there more A or more A') from the question that E was in fact presenting. This involved accepting S's response to the question that S was answering, and then re-presenting the experimenter's question, in amended form, by way of contrast. Thus if E asked: "Are there more of the A or more of the B?", to receive the reply: "More A"; and if E then asked: "There's more of the A than what?", to receive the reply: "There's more of the A than A'", E would then say: "All right, there's more of the A than A'; but what I want to know is: are there more of the

A or more of all the B altogether? Show me the A; show me all the B altogether; now which is more: are there more of the A or more of all the B?"

Of the 20 subjects tested, 2 answered the first item correctly with the inclusion question in standard form; thus 18 subjects remained amenable to facilitation. Of these 18 subjects, 13 answered the amended (item 1) inclusion question correctly after the above set of supplementary questions had been posed, and 5 subjects answered incorrectly. An illustrative protocol for each class of material can be considered:

Array: 6 children, 4 boys and 2 girls

F.G., female, 6;6. "Are there more of the boys or more of the children? - Boys. More boys than what? - Than the girls. There's more boys than girls, that's right. But are there more of the boys or more of all the children altogether. Show me the boys - bbbb. Show me all the children together - bbbogg. Which are there more of: more of the boys or more of all the children altogether? - All the children together."

Array: 9 animals, 6 horses and 3 cows

G.M., female, 5;11. "Are there more of the horses or more of the animals? - Horses. More of the horses than what? - Cows. More horses than cows, O.K. Tell me this time, are there more horses or more of all the animals altogether? Show me the horses - hhhhh. Now show me all the animals altogether - hhh hhhccc. Which is more: are there more horses or more of all the

animals altogether? - Horses. More horses than what? - Cows.
 All right, but are there more horses or more of all the animals
 altogether? Show me the horses - hhhhhh. How many? - Six.
 How many of all the animals? - Nine. Which is more? - Horses.
 Is six more than nine? - No. Which is more? - Nine. Which
 is more then: the horses or all the animals? - All altogether."

Array: 7 flowers, 5 red tulips and 2 yellow daffodils

P.T., female, 6;3. "Are there more of the flowers or more of
 the red flowers? - The red. More of the red flowers than what?
 - The yellow. Are there more of the red flowers or more of the
 flowers altogether? - More o' all the flowers together."

Array: 6 matches, 4 blue and 2 red

J.C., female, 6;3. "Are there more of the blue matches or more
 of the matches? - Blue. More blue matches than what? - Red ones.
 What about all the matches: are there more blue ones or more
 of all the matches altogether? - More o' them all."

Array: 9 sweets, 6 smarties and 3 polos

D.C., female, 6;4. "Are there more of the sweets or more of the
 smarties? - Smarties. More of the smarties than what? - Than
polos. There's more of the smarties than polos. Are there
 more of the smarties or more of all the sweets altogether? -
More of all the sweets."

Array: 7 paperclips, 5 wee and 2 big

P.N., female, 6;6. "Are there more of the wee paperclips or more

of the paperclips. - More of the wee ones. More of the wee ones than what? - The big ones. There's more of the wee ones than the big ones. But are there more of the wee ones or more of all the paperclips altogether. Show me the wee ones - wwwwww. Now show me all the paperclips altogether - wwwwwwbb. All right, which are there more of? - The little ones. More little ones than what? - Big ones. All right, but are there more little ones or more of all the paperclips altogether? - More of them altogether."

With the subsequent five items, before being presented with the amended inclusion question "A(all B)", S was first asked to point to "the A" and "all the B altogether". If S answered incorrectly on any item, supplementary questions were presented as with the first item.

This procedure may be contrasted with that of Kohnstamm (1963) who employed an explicit correction procedure, attempting to correct subjects' incorrect responses to standard inclusion questions by indicating an adequate justification rule:

(To S:) "You have to say that there are more B because A are also B. A and A' are all B and so there are always more B." For example - E: "Are there more animals or more cows?". S: "More cows". E: "No, that's not right. You're supposed to say that there are more animals, because cows are also animals"

(Kohnstamm, 1963: 330-331)

In contrast with this explicit correction procedure, our set of supplementary questions presented after an incorrect response might be described as an "implicit correction procedure", for we accept S's response to the question he is effectively answering, but then imply a contrast between this question and the one that E is actually posing. Thus when S says that there are "More A" when we ask: "Are there more of the A or more of the B", we never explicitly tell a subject that he is wrong; instead we imply a contrast by saying: "Yes there's more A than A", but what I want to know is - are there more A or more of all the B". Clearly, if S responds correctly to the supplementary questioning, this arises via implicit rather than explicit correction.

Results The results on the first item have already been indicated - the standard inclusion question was answered correctly by 2 subjects, and incorrectly by the remaining 18 subjects.

For the subsequent five items, where amended inclusion questions were posed, S's initial response has been recorded. (As already mentioned, if this initial response was incorrect, supplementary questions were introduced as with the first item.)

Distributions of correct and incorrect responses per item appear in Table 30:

Table 30:/

Table 30: Responses (Experiment 15)

Item	CI question form	Total responses	Correct	Incorrect
1	(standard	20	2	18
	(amended	18	13	5
2	amended	18	8	10
3	amended	18	13	5
4	amended	18	13	5
5	amended	18	13	5
6	amended	18	14	4

The distribution of responses across subjects for the five items 2 - 6 is as follows:

of the 18 subjects amenable to facilitation, 7 subjects answered all five items correctly, 6 subjects answered four items correctly, 2 subjects answered one item correctly, and 3 subjects answered no items correctly (initial response per item in each case).

Thus 13 subjects out of 18 show complete, or near complete, facilitation; and 5 subjects show no, or practically no, facilitation.

The difference between the proportion of subjects who respond correctly on the initial and subsequent items is significant ($z = 3.61$, $p(<.001)$).

Discussion These results suggest that when presented with a CI problem in standard form, subjects do not compare class and subclass, but rather subclass and subclass in the manner indicated above: i.e. by

restricting the interpretation of the "B" term to the minority subclass A'; however when an "implicit correction procedure" is introduced whereby the question S is effectively answering is contrasted with an amended form of inclusion question whose term-referents are clarified by rehearsal (S has to point to "the A" and "all the B altogether"), we find that a majority of subjects produce correct responses on at least four out of five occasions. This suggests that subjects who apparently fail with standard CI questions may nevertheless succeed in comparing a class and its majority subclass when the CI problem is clarified. If these results are stable, they clearly amend the anomaly in Piaget's account of inclusion where subjects appear able to compare class and subclass in a context of subtraction, but not inclusion, questions.

However, two criticisms of the present study might be advanced. First, consider those subjects who appear facilitated: is there any guarantee that such subjects are genuinely facilitated? In Piagetian studies, considerable emphasis is placed on the child's ability to justify his responses as an indication of his genuine understanding. In the present study, subjects were asked to justify their responses when correct: thus when they replied: "There's more B/more B altogether/more of all the B" to the amended question: "A(all B)", they were then asked: "Why are there more of all the B?". We can consider a "justification" for each class of material, produced by subjects who have been deemed "facilitated" above:

- (1) J.K., female, 6;1. "Are there more of all the children or more of the boys? - More of all the children. Why? - Because you

- count the girls in with the boys. And what do you get? - Six.
Six what? - Children."
- (2) C.R., female, 6;5. "Are there more of the horses or more of all the animals altogether? - More of all the animals together. Why? - There's nine. Nine animals; and how many horses? - Six. Is six more than nine? - No. Which is more? - Nine."
- (3) K.I., male, 5;10. "Are there more of the red flowers or more of all the flowers? - More of the flowers. Why? - Because there's one, two, three, four of the red ones, and two more of the yellow ones and that makes ...(counting them out now by pointing with his finger and so correcting himself as to the number of tulips of which there are five, not four as S has said) ...seven. Seven what? - Flowers altogether."
- (4) E.F., female, 6;5. "Are there more of the blue matches or more of all the matches altogether? - All the matches altogether. Show me them - bbbbrr. Why do you think there's more of all the matches altogether? - (no response)."
- (5) G.M., female, 5;11. "Are there more of the smarties or more of all the sweets altogether? - Altogether. Why? - 'Cos you join them altogether."
- (6) P.T., female, 6;3. "Are there more of the wee paperclips or more of all the paperclips? - More of all the paperclips. Why? - 'Cos there's seven. Seven what? - Clips. How many wee ones? - Five."

Clearly, "justifications" like (4) above present considerable difficulty, for while the child can point to her response: "(more of) all the matches altogether", she is unable to provide any verbal justification of this response. Justifications like (5) present analogous difficulties - the child produces a correct response accompanied by a "justification" which is inscrutable in Piagetian terms.

However justifications like (1), (2), (3) and (6) seem more satisfactory, for the child appears to provide some indication that the extension of the class is greater than that of the subclass whilst also recognising that the subclass contributes to the extension of the class. If such justifications can be considered adequate, it would appear that these correct responses result from genuine understanding. Of the 14 subjects who responded correctly on the sixth item in the present study, two subjects produced no verbal justification, the justifications of three subjects were of the inscrutable variety, and the remaining nine subjects produced responses which were "adequate" in the sense just described.

However the problem of justification of responses is clearly not confined to deciding what features a justification must possess in order to be described as adequate, for failure to produce any sort of justification can be interpreted in quite different ways (cf: Smedslund, 1966); thus the problem is not confined to asking what constitutes adequate justification - we must also ask whether lack of adequate justification is to be interpreted as signifying lack of adequate understanding, for failure to justify may simply be the result of the child's unfamiliarity in dealing with requests for

justification. When considering this question it is perhaps important to recall the infrequency, except in studies of the type being discussed, with which the child is faced with a request to justify correct responses. Indeed there is something to be said for the view that requests for justification in normal adult-child discourse may well be interpreted by the child as little more than rhetorical criticisms (cf: "Why did you break the window?"). Thus failure to produce adequate justifications may be due to genuine failure in understanding, or to being unused to having to justify correct responses, or to interpretation of the (adult) experimenter's "why?" questions as implied criticism. Clearly the whole problem of justification, and what motivates failure to obtain justification, is considerable. Thus while the ability to adequately justify correct responses may be seen as a sufficient condition of genuine understanding, it does not seem to be a necessary condition. In short, the problem of justification seems a special, perhaps more complex case of the general "translation" problem associated with the adult's interpretation of the child's utterances, and vice-versa, which has already been called to attention (see Braine, 1959; Bruner, 1966; Flavell, 1963; Hunt, 1961; Sigel, 1968; etc.).

The second, more specific, criticism of the present study concerns the stability of the data: we have found 13 subjects out of 18 facilitated. However these 18 subjects have been judged amenable to facilitation on the basis of their incorrect response to a standard inclusion question presented on but one item (the first item of six). It is conceivable that a proportion of these 18 subjects who answered the first item incorrectly did so through lapses

in attention, mis-hearing of the question, etc. and perhaps some of these 18 would have answered subsequent standard CI questions correctly had they been given an opportunity to do so. Thus confining the "screening procedure" to but one item in the present study is perhaps unsatisfactory, and in the following experiment we attempt both to meet this possible criticism and check on the stability of data by running a further group of subjects to whom standard inclusion questions are presented against the first three items in a series of nine items presented to each subject. This will constitute a more satisfactory "screening procedure", for subjects will only be regarded as amenable to facilitation if they respond incorrectly to two or three standard inclusion questions out of three.

Experiment 16

Subjects 20 naturally English speaking schoolchildren (8 male) of mean age 6;2 years (range: 5;6 - 6;8).

Material Nine classes of material as summarized in Table 31:

Table 31: Material (Experiment 16)

Class	Major subclass	Minor subclass
children	4 boys	2 girls
paperclips	5 wee clips	2 big clips
flowers	6 red flowers	3 yellow flowers
animals	4 horses	2 cows
circles	5 big circles	2 wee circles
matches	6 blue matches	3 red matches
sweets	4 smarties	2 polos
clocks	5 wee clocks	2 big clocks
umbrellas	6 green umbrellas	3 blue umbrellas

The six classes of Experiment 15 are therefore retained with some changes in ratios, and three further classes are added. Of the total nine classes, six are representations of the objects they depict (children, animals, flowers, circles, clocks, umbrellas: outline drawings individually

pasted on 1 x 1" cardboard squares, as before), while three classes (paperclips, matches, sweets) are physical objects. Further, of these nine classes, three (children, animals, sweets) involve subclasses whose names make no reference to their appropriate superordinate class name (e.g. smarties, polos, "sweets"; etc.), while the subclass names of the remaining six classes make direct reference to the superordinate class name (e.g. big circles, wee circles, "circles"; etc.). With half of those latter six classes, the subclasses are distinguished by size (big/wee paperclips, circles, clocks), and half by colour (red/yellow flowers, red/blue matches, blue/green umbrellas).

Procedure: The experimental set-up was as in previous experiments. Subjects were told they were going to play some games; Ss were tested individually by the same E, S and E sitting opposite one another at a small table in the centre of which there was placed a 9 x 9" red card. The classes of material, either physically present or represented on individual 1 x 1" cardboard squares were placed on this red card in a random arrangement. The customary naming procedure was then effected on presentation of each class of material, order of presentation of classes being counterbalanced across subjects.

With the first three items (items 1-3), S was asked an inclusion question in standard form: "Are there more of the A or more of the B?".

The next three items (items 4-6) were devoted to the implicit correction procedure of Experiment 15, and this proceeded exactly as before when S made an incorrect response to the amended inclusion questions presented for these three items:

"Are there more of the A or more of all the B altogether? - More A. More A than what? - More A than A'. Yes, there's more A than A'. But what I want to know is: are there more A or more of all the B. Show me the A ...Show me all the B altogether ...Now, which is more: are there more of the A or more of all the B altogether?"

With the last three items (items 7-9) the inclusion question was again presented in amended form: "Are there more of the A or more of all the B altogether?", S first being asked to point to the referents of these terms.

Subjects responses were recorded for items 1-3, and for items 7-9.

Results The distributions of correct and incorrect responses for the first and last sets of three items are presented in Table 32:

Table 32: Responses (Experiment 16)

Item	CI question form	Total responses	Correct	Incorrect
1	)	20	2	18
2	) standard	20	2	18
3	)	20	1	19
7	)	19	14	5
8	) amended	19	17	2
9	)	19	14	5

The distribution of these responses across subjects is as follows:

Items 1-3: Of the 20 subjects tested, 1 subject gave three correct answers, 2 subjects gave one correct answer, and 17 subjects gave no correct answers to the standard inclusion questions presented. Thus 19 subjects were judged amenable to facilitation³⁸, only one subject giving adequate indication of being able to respond correctly to standard CI questions (i.e. correct on at least two out of three occasions), this latter subject not therefore being tested further.

Items 7-9: Of the 19 subjects tested, 12 subjects gave three correct responses, 4 subjects gave two correct responses, 1 subject gave one correct response, and 2 subjects gave no correct responses. Thus 16 subjects are facilitated, having given two or three correct responses to three items, and 3 subjects are unfacilitated, having given only one, or no correct responses to three items. Of the 16 subjects regarded as facilitated, 11 subjects provided justifications which appear adequate in the sense described above (i.e. S appeared to recognise that the extension of "all the B" was greater than the extension of "the A" while "the A" contributed to the extension of "all the B"), 1 subject provided justifications which can be described as "inscrutable", and 4 subjects failed to provide any verbal justifications.

The difference between the proportion of subjects who respond correctly on the first and last sets of three items is significant ($z = 4.00$, $p < .001$).

Discussion These results suggest that the results of the previous experiment enjoy a measure of stability, at least when the experimenter, and possible experimenter effects³⁹, are held constant.

Thus subjects who fail to answer standard CI questions of the type employed by Piaget may nevertheless be able to compare class and subclass when amended inclusion questions are presented, the terms of which have been clarified.

Before attempting to indicate the implications of these results, we first summarise our main arguments and findings.

Chapter 5

Retrospect

The general disparity between recent studies of the child's linguistic and cognitive abilities was noted in Chapter 1: study of language acquisition suggests that the child can handle much of the complexity of language from about age four years, while Piagetian study of cognitive development suggests that the child is unable to handle a relatively simple problem such as class inclusion until about age eight years, and in some cases (e.g. with certain classes of animals), not until about age twelve years.

The importance which Piaget attaches to the problem of class inclusion was indicated in Chapter 2, where it was noted that Piaget regards the child's ability to handle inclusion the decisive test of genuine classification, a fundamental ability in any theory of cognitive development, as was Piaget's view that the child of below about eight years is unable to solve class inclusion problems because of an inability to simultaneously compare a class and subclass. It

was further noted that the problem of class inclusion, in Piaget's view, shares no radical or fundamental relation with language, which is accorded an important, but nevertheless subsidiary role in the development of cognitive abilities.

Attention was then drawn to the fact that while Piaget attaches no fundamental importance to language, his studies of class inclusion have invariably employed language as a vehicle for study - i.e. the experimenter asks the child questions which the child must interpret, and then produce a verbal response which must in turn be interpreted by the experimenter. Several writers have called attention to this aspect of Piagetian studies, suggesting that in order to estimate the influence of language, one needs to manipulate the verbal aspects of the task. While accepting this general sentiment, it was noted that there seems no way of deciding, a priori, which verbal aspects require variation. There being no established experimental literature on this question, the problem was approached indirectly by considering studies in the psychology of language where various aspects of language have been subject to some previous inquiry.

Thus in Chapter 3 it was observed that in recent years considerable emphasis has been placed on language structure (syntax), even in consideration of communicative function: i.e. the syntactic structure of an utterance may be altered to facilitate communication by, for example, producing an utterance in the passive, rather than use an active construction. The idea that one may alter the syntax of utterances in discourse in order to communicate more effectively clearly held some appeal, for it suggested that syntactic aspects of

the discourse employed in presenting inclusion problems might well be varied lest the syntax customarily employed underlies communicative misunderstandings between subject and experimenter.

However before adopting such a move, the idea that manipulations of syntax facilitate communication was examined further, and consideration of the nature and type of utterance employed in previous experiments which produced this conclusion led us to question its viability. Presentation of an alternative topic-comment account, which utilized a distinction between the topic and comment of an utterance thus placing considerable emphasis on certain aspects of discourse, was found to be more satisfactory in Experiments 1 and 2, where the predictions of TC were confirmed, but the majority of the predictions of the "syntactic account" (based on voice and word-order) unconfirmed. This suggested that semantic aspects of language, held to reflect certain discourse parameters (subsequently confirmed in Experiments 3 and 4), were of considerably greater importance than had been previously recognised. It was therefore to semantic aspects of class inclusion that we turned in Chapter 4.

There a number of anomalies concerning the semantics of inclusion problems were detailed. First, there was the general disparity between the child's linguistic abilities at about age four years when he can produce utterances like: "A dog is an animal", "A daisy is a flower", apparently recognising that an object is a member of a class from which it is drawn, and apparently handling the semantics of such terms as dog, animal, daisy, flower, etc. with success. However on presentation of a class inclusion question like: "Are there more flowers

or more daisies?", the child answers incorrectly until about age eight years. Thus whereas the child's production of the former type of equational sentence suggests that it can handle the semantics of such terms as daisy, flower, etc. at about age four years, his responses to the latter type of inclusion question suggest that he cannot handle the semantics of such terms until about age eight years.

Second, Piaget reports that when class inclusion problems are presented against certain classes of animals, the child may continue to answer incorrectly until about age twelve years; this simply compounds the disparity.

Third, Piaget also reports that while children between 5-8 years are unable to co-ordinate class and subclass in a context of inclusion questions ("Are there more A or more B": i.e. $A(B)$), they can nevertheless handle the semantics of such terms in a context of subtraction questions ("If you take away the A/A', are there any B left": i.e. $B-A = A'/B-A' = A$; "If you take away all the B, are there any A/A' left": i.e. $-B = -(A+A')$, or $B = A+A'$). The child of 5-8 years answers these latter subtraction questions correctly, suggesting that he can handle the semantics of terms like "A", "A'", and "B", and apparently indicating appreciation of those relations of composition ($B = A+A'$) and decomposition ($B-A = A'/B-A' = A$) which Piaget holds to constitute the reversible (concrete) operation involved in solution of class inclusion problems, where successful solution is held to depend on a co-ordination of these relations into an operational whole. But when these results are stripped of Piagetian terminology, we seem left with yet another anomaly:

the child can apparently handle the semantics of terms like "A", "A'" and "B" in a context of subtraction questions, but not in a context of inclusion questions.

Fourth, we observe a further anomaly, or inconsistency, in the semantics associated with erroneous responses to class inclusion questions in children below about age 8 years. On presentation of the inclusion question concerning class and minor subclass ("A'(B)"), we find that the child responds correctly: "B". But when we present an inclusion question concerning class and major subclass ("A(B)"), the child now answers incorrectly: "A". We find that Piaget holds the former response to be misleading, for both minority and majority inclusion questions are held to be reduced by the child to subclass-subclass comparisons (A:A'), and with the former minority question, according to Piaget, the larger subclass A is "simply called" by the class term "B". However there is clearly no such process with majority inclusion questions. Therefore we seem left with yet a further anomaly: the major subclass A is "simply called" by the class term "B" in one type of inclusion question (minority), but not in another (majority).

Of all the aspects of Piaget's account of inclusion, perhaps the most difficult to accept is the notion that children are unable to solve class inclusion problems in certain contexts (e.g. with classes of animals) until about age twelve years. Our initial step was therefore to examine Piaget's account of this "time lag" which Piaget, in an admittedly a posteriori fashion, attempts to explain in terms of "remoteness from everyday experience": i.e. although the child may be used to making collections of various

types of flowers, he is unlikely to be used to making collections of various types of animal. The "remoteness" of the latter class may therefore contribute to the delay in solving class inclusion problems concerning such classes of material. But the notion that a class of animals is more remote from experience than, say, a class of flowers, has more the appearance of an hypothesis than an explanation; it was therefore treated as such and tested in Experiment 5. When the child's performance on material which Piaget holds to be familiar (i.e. a class of flowers) was compared with performance on material genuinely remote from everyday experience (nonsense syllables which referred to animate-like nonsense figures), no differences were found in the performance of a group of 9-12 year old subjects on $A:A'$, $A'(B)$ or $A(B)$ comparisons; thus Piaget's hypothesis was not confirmed. Although we did observe a significant difference in the performance of a younger group of $5\frac{1}{2}$ - $8\frac{1}{2}$ year old subjects on $A(B)$ inclusion questions between familiar and remote material, we also found significant differences on $A'(B)$ and $A:A'$ comparisons. This suggested that any "time lag" was not to be explained in terms of the remoteness or unfamiliarity of the material per se, but rather in terms of unfamiliarity with the names of the material constituents. It seems that the younger subjects may have experienced difficulty in keeping track of the subclass names of the nonsense material (indicated by their significantly lower scores on $A:A'$ comparisons) which could by itself have led to the significantly lower scores on $A'(B)$ and $A(B)$ inclusion comparisons; the older group on the other hand seem to have experienced no such difficulties with the nonsense material, there being no significant

differences between A:A' comparisons with familiar and remote material, and likewise no significant differences with the inclusion questions. Thus the "time lag" seems more concerned with the ability to co-ordinate the names and referents of class inclusion questions than with the remoteness of the content material.

The plausability of such a link was therefore checked in Experiment 6, where the ability to spontaneously name the classes of experimental material employed (children, animals, flowers) was compared with the child's ability to make A:A', A' < B and A < B comparisons. With a group of 6 year olds, we found differences in the way in which these classes of material were spontaneously named, as one might expect on the basis of arguments presented in Brown (1958): with children and animals, the child tended to name the material via the subclasses but not the classes, but with flowers the opposite pattern was observed - the child tended to name the material via the class but not the subclasses. Comparing mean correct responses for the three classes of material, we found significantly more correct naming, and comparison, responses for children than animals than flowers. Thus the pattern of subsequent comparison responses directly mirrored the initial pattern of spontaneous naming responses.

However while Experiments 5 and 6 suggested the existence of a link between the abilities to name and compare, they provided no indication as to the nature of such a link; thus more intensive study with a smaller group of four year old subjects was undertaken in Experiment 7.

There the pattern of spontaneous naming responses was similar to that of Experiment 6: subjects named the class but not the subclasses for flowers, but the subclasses rather than the class for children and animals. With comparison questions, the pattern of data for children and animals conformed to that previously reported in the literature: success was observed with comparison of subclasses ($A:A'$), apparent success with minority inclusion questions ($A'(B)$), and failure with majority inclusion questions ($A(B)$). However the pattern of data for flowers was inverted: failure with $A:A'$, failure with $A'(B)$, and apparent success with $A(B)$ questions. Before attempting to discuss these rather intriguing results, the study was replicated with a different group of subjects in Experiment 8. Results were precisely as before.

It was surmised that these data might be explained with the assumption that the subjects of Experiments 7 and 8 had confused the terms and referents of the class of flowers - i.e. "tulips" was taken as referring to the daffodils, and "daffodils" was taken as referring to the tulips. This would not only explain the observed lack of success with $A:A'$ comparisons, but also the inverted pattern of data for $A'(B)$ and $A(B)$ inclusion questions: whereas we customarily observe apparent success with the former and failure with the latter, with flowers we observe failure with the former and apparent success with the latter; but the assumption that A and A' have been confused for flowers renders the $A'(B)$ question in effect an $A(B)$ question, and the $A(B)$ question in effect an $A'(B)$ question.

Since this assumption could account for the anomaly in results, it was checked in Experiment 9, where it was reasoned that the inverted

results for the inclusion questions with flowers should re-invert when the referents of "A" and "A'" were clarified. When majority and minority inclusion questions were re-presented to the subjects of Experiments 7 and 8, the referents of the subclass terms being clarified by speaking of "red/yellow flowers" in place of "tulips/daffodils", the predicted re-inversion of the pattern of data was observed: minority inclusion questions were now handled with apparent success, majority inclusion questions with failure.

Thus these experiments not only confirmed the importance of semantic aspects of class inclusion, but also suggested hypotheses as to the processes underlying erroneous responses to class inclusion questions which contrasted with Piaget's account.

First, we supposed, with Piaget, that when erroneous responses to class inclusion questions occurred, the child reduced such inclusion comparisons to a comparison of subclasses. But it was suggested that this does not arise because the child is unable to simultaneously compare class and subclass, but because of the way in which the child uses the language associated with class inclusion questions. For we supposed that with both majority and minority inclusion questions, there is a process of short-term restriction in the application of the class term "B": i.e. the child interprets "B" as referring to subclass A in minority inclusion questions ("A' < B"), but to subclass A' in majority inclusion questions ("A < B"). This was suggested by consideration of the patterns of data when the referents of "A" and "A'" were confused (Experiments 7 and 8, flowers), for on the assumption of short-term referential restrictions, one

would predict just the inverted pattern of data that was observed.

Thus it was argued that a process of short-term switches in reference of the class term "B" between majority and minority inclusion questions would reduce the anomalies in Piaget's account of inclusion, for an identical process is now envisaged underlying erroneous responses to both types of inclusion question, whereas there appears to be a difference in the processes underlying such responses in Piaget's account; and the assumption that "B" is restricted on specification of a subclass (as in inclusion questions) suggested that no such restrictions obtain where subclasses are not specified - e.g. with subtraction questions. Thus our assumption could also reduce the anomaly between the child's performance in contexts of subtraction and inclusion questions, where the child appears to appreciate the relations of composition and decomposition ($B = A + A'$; $B - A = A'$, $B - A' = A$) in the former context, but not in the latter.

This assumption was tested in Experiment 10, where it was predicted that in utterances which did not specify subclasses, the class term "B" would be interpreted as referring to both subclasses ($"B" = A + A'$), but interpreted as referring to subclass A in connection with minority inclusion questions ($"B" = A$ with $"A'(B)"$), and as referring to subclass A' with majority questions ($"B" = A'$ with $"A(B)"$). Results from a group of 5 year-olds confirmed these predictions, especially for the inclusion questions: clearly, there were short-term restrictions in the reference of the class term "B". While the results for utterances containing no specification of subclasses were

reasonably clearcut ("B" was interpreted as referring to A+A' 80% of the time), there was however an interesting feature to these results: namely, it seemed as if there was some "spontaneous restriction" (i.e. restriction not induced by specification of a contrastive subclass) of the class term "B". This suggested that "B" may be restricted, not only through specification of a contrastive subclass, but may also be spontaneously restricted through uncertainty as to its application.

Experiment 11 therefore presented the subjects of Experiment 10 with a set of subtraction questions in order to observe whether such "spontaneous restriction" occurred (i) with a different context of questions, (ii) when such questions were manipulated for clarity of reference. It was found that spontaneous restriction did occur when the reference of "B" was unclear: thus "B" was at times restricted to one or other of the subclasses when the subtraction questions referred to "the B", but there was never any restriction when the reference of "B" was clarified - i.e. in subtraction questions which referred to "all the B".

These results were then related to the anomaly in Piaget's account where he reports success in handling such terms as "A", "A'" and "B" in subtraction questions, but not in inclusion questions - we find that Piaget's subtraction questions referred to "all the B", whereas his inclusion questions referred to "the B". This suggested the interesting hypothesis that the reason the child fails to handle inclusion, but not subtraction questions lies in a difference between the clarity of reference of the class term "B" between these two contexts of question. It was therefore supposed that should the

reference of "B" be clarified in inclusion questions (where the child customarily meets with failure) in the way in which it is clarified in subtraction questions (where the child customarily meets with success), we might then observe success with inclusion questions.

This hypothesis was tested in Experiments 12 through 16, where performance on standard inclusion questions of the type presented by Piaget ("A(B)") was compared with performance on amended inclusion questions which attempted to clarify the reference of the class term ("A(all B)").

In Experiment 12, results from a group of 5 year-olds were largely contrary to expectation: only 5 subjects out of 16 were facilitated with amended inclusion questions. For the unfacilitated subjects it was surmised that the term "all the B" was being restricted as in previous experiments - i.e. "all the B" was being restricted to subclass A', as was the term "the B" in previous studies. In an attempt to clarify the reference of the term "all the B", subtraction questions were therefore interposed between presentation of standard and amended inclusion questions in Experiment 13, on the supposition that the distinction between subtraction of "the B" and subtraction of "all the B" would clarify the reference of the latter term for the child. However results from a group of 6 year-olds were again largely contrary to expectation: of 18 subjects in Experiment 13, only 3 were facilitated with amended inclusion questions; the introduction of subtraction questions had failed to clarify the reference of "all the B" in subsequent amended inclusion questions for the remaining 15 unfacilitated subjects.

Again it was surmised that these subjects were restricting the reference of "all the B" in amended inclusion questions as was the case with "the B" in standard questions. This was checked by examining the protocols of supplementary questions presented, after the experiment proper, to the last 6 subjects of Experiment 13, all of whom were unfacilitated. Consideration of the protocols suggested that our explanation of lack of facilitation was correct. Therefore in the next experiment we attempted to prevent restriction of the term "all the B" to subclass A' by presenting questions of the form: "Are there more of the A, more of the A', or more of all the B altogether?", supposing that explicit specification of the term "A'" might prevent restriction of "all the B" to subclass A'. Employing this procedure in Experiment 14, a majority of a group of 6 year-olds was facilitated.

However the series of items on which these subjects were tested was somewhat limited, and some subjects apparently continued to restrict the term "all the B" to subclass A'. Thus in Experiment 15 a longer series of items^{as} was presented, and an "implicit correction procedure" was introduced. That is, on presentation of a standard inclusion question ("A(B)") against the first item, if S answered: "More A", he was asked: "More A than what?"; the reply being invariably: "More A than A'". E then accepted this response for the question that S was effectively answering, but then contrasted this question with the one that E was in fact presenting: "Yes, there's more A than A'. But what I want to know is: are there more of the A or more of all the B altogether?". Before S answered, he was asked to point to "the A" and "all the B altogether".

Introduction of this implicit correction procedure resulted in 13 subjects out of a group of 18 six-year-olds being facilitated. More than half these facilitated subjects produced adequate justification of correct responses, providing some indication that they appreciated that the extension of major subclass A contributed to, but was less than, the extension of the class B.

This study was repeated in Experiment 16, where with a longer series of items which incorporated a more efficient screening procedure, 16 subjects out of a group of 19 six-year-olds were facilitated, 11 of these 16 providing adequate justification of correct responses.

The immediate implications of these findings seem clear, for they suggest that subjects who fail to answer standard class inclusion questions of the type presented by Piaget may nevertheless be able to compare class and subclass provided that the referents of the terms in inclusion questions are made clear. Thus our studies appear to account for the anomalies in Piaget's account of class inclusion.

However besides these specific implications, our studies also appear to suggest more general implications which, because of their possible relevance to further inquiry, may be briefly considered in conclusion.

General Implications

It seems that at certain points in development, the child's use of language differs from the adult's use of language, for the

child does not hold constant the reference of class terms like animal, flower, etc. as does the adult: rather the way in which the child uses such terms depends on the context of question (subtraction or inclusion), the type of question (majority or minority inclusion questions), and, especially, the clarity of reference of the terms themselves ("B" or "all B"). Thus interpretation of class terms in the child of below about age eight years seems determined by the context and type of question in which such class terms appear, for in some contexts the child uses class terms to refer to the subclasses as does the adult, while in other contexts he restricts the reference of class terms according to the type of question presented, although such restrictions of reference are short-term, and of course, restrictions depend on clarity of reference. Thus we might summarise the way in which the child uses the language by suggesting that between different types and contexts of utterance, the child employs short-term referential switches in the application of what we might call "unclarified" class terms; this clearly differs from the way in which such terms are employed by the adult.

However this is not to say that the child is unable to use the language in the way in which it is used by the adult: simply that in certain contexts he does not do so. Of course what motivates the pre-eight-year-old child to use the language of inclusion questions in the way that he does cannot be answered from the present studies. Suggestions have been made (e.g. Braine, 1962; Wallach, Wall & Anderson, 1967; Wohlwill, 1968) that perceptual set may play a significant role⁴⁰ - present a child with an array of dogs (A) and cats (A') and ask:

"Are there more dogs or more animals?", the perceptually potent distinction between A and A' may well encourage the child to assume that the question must concern the subclasses, leading to the customary response: "More A". However while this argument has certain appeal for majority inclusion questions, results with minority inclusion questions (customary response: "More B") point to the importance of co-ordination of question-terms and object-referents, as do results with subtraction questions, and comparison of results when terms are clarified and unclarified.

Of course further inquiry must not only consider what motivates the pre-eight-year-old to use the language of standard class inclusion problems in a way different from the adult, but also what underlies the responses of post-eight-year-old children who use the language in a way similar to the adult: that is, we must find out what underlies this change in the way in which the language is used. It seems as if this will only be uncovered by intensive longitudinal study of individual children.

A further implication of our studies concerns the way in which the language is used by the child: it seems that this is far more complex than might have been expected; in this respect our studies support the findings of other recent studies which have observed considerable complexity in the child's use of language in contexts of comparison, description and discrimination (e.g. Campbell & Wales, 1970; Donaldson & Balfour, 1968; Donaldson & Wales, 1970a, b; Taylor & Wales, 1970; Wales, 1970; Wales & Campbell, 1970). This has clear implications for study of semantic development and linguistic

comprehension: estimates of the child's ability to correctly interpret linguistic meanings appear sensitive to the type and context of question with which we attempt to elicit responses.

This leads to the perhaps most general implication of this dissertation: namely, our studies suggest that the controversy over the relationship between language and thought be viewed as an empirical issue, not an issue to be decided by a priori argument, for in considering the role of language in study of an aspect of cognition, our studies suggest we must look to see if, and if then how, language and cognition are related. And to return to the remarks of the previous paragraph, further study must be ready for the possibility that such relationships, where they obtain, may be involved and complex.

Finally, we can indicate the sort of problem encountered in the present studies by quotation of two brief remarks:

Though we often think of each thing as having a name - a single name - in fact, each thing has many equally correct names.

(Brown, 1958)

Don't look for the meaning of a word, look for its use.

(Wittgenstein, 1953)

That is, we must constantly keep in mind that language does not simply involve words that name objects: objects can be referred to in various ways, equally acceptable dependent on context; if we wish to understand the processes underlying the child's responses across various contexts, we must look and see how the child is

using the language. Thus these remarks of Brown and Wittgenstein might well be adopted as mottos for further inquiry, and the studies of the present dissertation interpreted as evidence of their worth.

Notes

1. These publication dates refer to the English translations of Piaget's works originally published in French. The original dates of publication, and French titles, can be found in Flavell (1963). A possible source of confusion concerns the book we refer to as Inhelder & Piaget, 1964. This refers to: The Early Growth of Logic in the Child: Classification and Seriation, published in English translation by Routledge & Kegan Paul: London, 1964, where the order of authors reads Inhelder & Piaget. However this is a translation of La genèse des structures logiques élémentaires: classifications et sériations, published by Delachaux et Niestlé: Neuchatel, 1959, where the order of authors reads Piaget & Inhelder. Thus Inhelder & Piaget (1964) (English translation) is identical with Piaget & Inhelder (1959) (French original).

2. Of course there are general arguments, deriving from consideration of the cognitive abilities of individuals "without language", to the effect that language and cognition are not radically related (e.g. Furth, 1964; Inhelder & Piaget, 1964; Piaget & Inhelder, 1969). However these arguments appear inconclusive, largely due to the meaning of the phrase "without language" being left unspecified. Since individuals may comprehend language without being able to produce it (Lenneberg, 1962), it seems necessary to distinguish individuals

who are "without language competence" from individuals who are "without language performance". If the latter possess linguistic competence, they clearly possess language in an important sense, despite the fact that they cannot produce any utterances.

3. In place of providing a brief summary of the Piagetian position on class inclusion and language, we prefer to employ extended quotations from Piaget's own writings, for, in attempting to indicate his position via brief paraphrase, it is all too easy to inadvertently misrepresent the position he wishes to present (a fact attested by Piaget's often justified complaints concerning misrepresentation).
4. "4;0" denotes the subject's age as being "4 years; 0 months". This convention will be followed throughout.
5. As we will come to see, Piaget suggests that the stage-2 child appreciates the relation $B = A + A'$ in an intuitive, rather than operational, fashion.
6. Read $A(B)$ as: is A included in B, which is customarily glossed as: Are there more A or more B.
7. The term "simply" in "simply calling" appears in the English translation (Inhelder & Piaget, 1964: 107), but not in the original: ((S'il y a plus de A que de A' l'enfant semble parfois répondre juste ($B(A')$), parce qu'il appelle B les A (or en ce cas $A(A')$).)) (Piaget & Inhelder, 1959: 110).

8. Piaget's example, originally quoted on p.20 above, arises for a situation where $A' \supset A$. Since we wish to reserve A and A' to denote major and minor subclasses respectively (p.10 above), Piaget's example (both in translation and original) quoted at this point has been amended so that $A \supset A'$. Substitution of A for A' , and A' for A , in no way affects Piaget's explanation of responses to minority (minor subclass (whole class) inclusion questions.

9. Cf: Donaldson's review of Inhelder & Piaget (1964): "It might not be too inadequate a summary of the book to say that it consists in an attempt to show that, in the absence of special inquiry, the child's ability to handle language may grossly mislead us as to his ability to handle classificatory systems" (Donaldson, 1960: 182). (Donaldson's 1960 review of Inhelder & Piaget (1964) of course refers to the original 1959 publication in French - see Note 1 above.)

10. Slobin (1963) reports that while passives took longer to process than actives, this result was obtained with "reversible" sentences, where an interchange of subject and object nominals does not lead to anomaly (e.g. the lorry was bumped by the car; interchange: the car was bumped by the lorry - both sentences are acceptable). When "non-reversible" sentences were used, where interchange of subject and object nominals does yield anomaly (e.g. the watermelon was eaten by the man; interchange: *the man was eaten by the watermelon), the difference in processing times largely disappeared. Thus introduction of

non-reversibility made passives about as easy to handle as kernals, and passive negatives about as easy to handle as negatives. Slobin argues: "Non-reversibility facilitates comprehension of passive sentences in that, although the normal subject-object order is reversed, it is still clear which of the two nouns is subject and which object" (Slobin, 1963: 69, 70).

11. Cf: Frege (1879): "In language the place occupied by the subject in the word-order has the significance of a specially important place; it is where we put what we want the hearer to attend to specially." By "subject" Frege intends: "the concept with which the judgement is chiefly concerned," (see Geach & Black's translation, 1960: 3).
12. It appears that children might obtain information from the sort of question variables just mentioned; for example Brown (personal communication) has surmised, largely from informal observation of her own children, that suprasegmental features of questions might well be an important source of information to the child: e.g. the stress and intonation an adult introduces into a question may provide the child with information as to how the adult expects the question to be answered. Of course, as Gill Brown would be the first to recognise, this is no more than a hypothesis which requires testing; however it is interesting to envisage some of the practical difficulties which might occur in systematic study of this sort of variable. While the perennial difficulties are fairly obvious - gaining access to

suitable subjects and accommodation, and obtaining sufficient data from experimental sessions which are necessarily brief - other difficulties are more subtle. Clearly the stimulus sentences (questions) must be controlled as regards their suprasegmental parameters; and while the most obvious way of achieving this is to pre-record them on tape, thereby introducing appropriate control, it is in fact doubtful if an experiment could be conducted in this way, for in discussion, Gill Brown (to whom I am indebted for much useful discussion of this area) has suggested that young children often fail to attend to tape recorded sentences/questions, because the child customarily watches the face of any questioner. This suggests that children may in fact pick up information not only via such acoustic features of language as stress and intonation, but also via visual cues (such as eye-brow-raising, head-inclination, etc.) which may accompany such acoustic features. (Perhaps presentation of stimulus questions on video-tape would meet this sort of difficulty?) However while experimentation in this area could possibly prove fruitful, we leave it aside at present, and in what follows, restrict attention to standard Piagetian-type questions, counterbalancing where appropriate, and adopting unstressed, "normal" intonation contours - see Note 27 below.

13. Some interesting, though varied discussion of the topic-comment distinction appears in: e.g. Chomsky, 1965; Fillmore, 1970; Hockett, 1958; Kirkwood, 1969; Lyons, 1968; Moore, 1967; Rommetveit, 1968; Strawson, 1964; Wilson, 1926.

14. A study employing a substitution-in-frames technique has observed that the surface subject (i.e. logical object) of passives is likely to be animate (Clark, 1965). Of the passive sentences used to describe (R) situations, the surface subjects are animate in half of these, inanimate in the other half. Of the passives used to describe (NR) situations, the surface subjects are all inanimate.

15. Note that such questions as "What?", "Eh?" etc. are often interpreted as requests to repeat an utterance after distraction of a participant in (adult) discourse exchanges. (In adult-child exchanges such questions often appear to function as requests for clarification/reformulation of the utterance just produced - cf: Campbell & Wales, 1970). No such questions appeared in subject's responses.

16. Specifically, there appears to be a considerable amount of inconsistency in responses, and a large effect from "reversibility", on sentence-type 1 compared with types 2 through 8. First, whereas 40% of all subjects responding to type 1 did so inconsistently, the mean percentage for subjects who responded inconsistently on the other seven types is 6% (range: 0-15%). Second, for type 1, of the 20 subjects working with R sentences, 1 gave "unclassified" responses, 4 consistently opted for N1, 3 for E, 4 for N2, and the remaining 6 were inconsistent; of the 20 subjects working with NR sentences, none gave "unclassified" responses, 1 consistently opted for N1, none for E, 17 for N2, and the

remaining 2 were inconsistent. Considering the percentage of subjects who contributed to a consistent option for N2, in sentence-type 1 there is therefore a difference of 65% between R and NR contributions. A difference on this scale did not occur for significant options on any other sentence-type, where the mean percentage difference between R and NR contributions for types 2 through 8 was 30% (range: 10-35%). These comparisons suggest that data for type 1 differs in kind, not just in degree, from types 2 through 8. However, since VWO and TC have little to say about data for sentence-type 1, we do not pursue the matter further.

17. See Lyons, 1968: 341.
18. While this may be valid for purposes of the present experiment, it should be pointed out that there can be difficulties associated with such a move in certain contexts of use which exhibit an asymmetry between uses of proper names and definite descriptions; for some interesting discussion of this issue, see Garner (1969) and New (1968).
19. The persons chosen to appear in the clips were - Clip A: a lecturer who was likely to be familiar to the experimental subjects (undergraduates); Clip B: a research assistant who was likely to be unfamiliar to subjects. Since there was no way of guaranteeing that these persons were, respectively, "known" and "unknown" beforehand, subjects were screened after the experiment, and protocols withdrawn where the appropriate conditions had not been met - see Procedure, p. 61 above, and

Results, p. 63 above.

20. It was intended to improve the reliability of data in Experiment 4 by running further subjects, but this proved impossible when further access to a video tape recorder could not be obtained.
21. A study by Muscio (1916), within the context of giving testimony in a court of law, raises the question why (i) is a neutral, but (ii) a leading question:

(i) did you see a pistol on the table

(ii) did you see the pistol on the table

Clearly, the latter requires the respondent (witness) to acknowledge previous acquaintance with the object in question.

22. A number of points of some further interest arise from Experiments 1-4.

First, we might inquire as to the role of definiteness in generic sentences (i) - (iii), which all apparently express the same proposition (cf: Perlmutter, 1970), and whose differential marking for definiteness appears largely irrelevant:

(i) Whales are mammals

(ii) The whale is a mammal

(iii) A whale is a mammal

We might ask if definiteness only assumes relevance in relation

to identifiability (cf: Rommetveit, 1968: 86 ff., 187; and for an interesting proposal on identifiability and agent-deletion in short passives, see Rommetveit, 1968: 292 ff.), for failure to mark nominals for definiteness (e.g. by using "someone", "a + nominal", etc.) may signal either an inability to identify the person or object nominal (e.g. (iv)), or an unwillingness to identify the subject and/or object of the sentence in order to leave the event as topic (e.g. (v) - cf: New, 1968):

(iv) If you get lost, ask someone the way

(v) I want you to deliver a letter to someone
in London

While the speaker is clearly unable to identify "someone" in (iv), the speaker must be able to identify "someone" in (v) although he has apparently chosen not to in order to retain another aspect of his utterance as topic. When such considerations do not arise, as in (i) - (iii), the relevance of marking for definiteness appears diminished. (Further discussion of this point may also require consideration of specificity - cf: Garner, 1969; Geach, 1965; Johnson-Laird, 1969a, b; Lyons, 1968).

Second, we might ask how topicalization relates to language acquisition. (A recent analysis of language acquisition data (obtained from one child) suggests that the traditional division of a sentence into subject and predicate may not be so fundamental as a division into topic and comment - cf:

Gruber, 1967). Piaget (1926) suggests that language may be initially employed by the child in a cognitively ego-centric fashion; "dual monologues" occur where two children at play each provide a running commentary on what (s)he is doing, but where there is a fundamental failure to communicate with each other. While this may be so in certain situations (e.g. where each child is engaged in a separate play task), listening to the discourse of young (3-4 year old) children in a co-operative/competitive play situation (e.g. if one child is building a tower of bricks and another child is trying to build another, taller tower) suggests that failure to communicate is not a general feature of their utterances, although of course there may well be specific failures of communication. This consideration, and the observation that specific failures of communication can occur in adult discourse, suggest that the interesting question does not lie in failure to communicate as such, but rather in whether failures of communication in children's discourse differ radically from those in the discourse of adults. For example, failure to communicate in adult discourse often appears to arise when the presuppositions of the speaker are not met in the listener: do failures in communication between children arise in a similar, or radically different, fashion? (cf: Moore's (1967) interesting remarks on "topic-delection"). If the former, this would indicate that the child is aware of some of the parameters governing discourse exchanges.

Alternatively, we might ask how topicalization relates to interpretation of the child's utterances. In recent studies of language acquisition in children, it has been realised that traditional tape-recordings of the child's production output often do not contain sufficient information to permit interpretation of the transcribed utterances. This can be illustrated with an example reported by Brown & Fraser (1963): how are we to interpret the utterance dinner all gone, for it may have been produced:

- (a) When the child has swallowed the last spoonful
(meaning, "I have finished my lunch")
- (b) As the child's plate drops from the high-chair
to the floor (meaning, "my lunch has disappeared")
- (c) As the mother stacks the dishes in the sink
(meaning, "we are finished with the business of
having lunch")

Clearly, if we had precise information as to the topic of the child's utterance, this sort of problem would be partially resolved. (The importance of recording this sort of contextual information has recently been discussed in Capmbell & Wales (1970), and illustrated in a study by Bloom (1970).)

Third, we might ask how far the notion of topicalization will permit interpretation of negative sentences. One of the problems that arises in processing sentences like: the

circle and the triangle are not red, appears to stem from difficulty in deciding precisely what is being negated. (cf: Wales & Grieve, 1969). This is brought out in even more pointed fashion with a sentence like: John did not drive from Edinburgh to London on Saturday, which has a large number of possible interpretations - for example, consider some possible adjuncts to the sentence:

- (a), but on Sunday
- (b), - he travelled by train
- (c); he only went as far as Newcastle
- (d) - Tom did

Etc.

As soon as we are given information as to topic: (a) time of travelling; (b) mode of transport; (c) destination; (d) driver of vehicle; etc., the ambiguity is resolved.

From these remarks it is clear that Experiments 1 - 4 create a demand for further inquiry, and our emphasis on the potential importance of the notion of "topicalization" appears justified in that it demands consideration of discourse parameters (e.g. presupposition relations) relevant to interpretation of linguistic structures. However we will not attempt to pursue these matters here.

23. Piaget refers to Sinclair's "comparatives" as "vectors" and to Sinclair's "absolute terms" as "scalars" (Piaget & Inhelder,

1969: 89).

24. For a fuller account of this argument, see Campbell & Wales (1969), where it is interesting to find that syntactic derivations of comparative structures recently proposed by linguists such as Chomsky (1965) are faulted not only on the clumsiness of the formalisations involved, but also because the surface syntax is derived from base strings whose semantic implications are unwarranted.
25. Notice that this can only be achieved by centring on the children's linguistic production (elicited descriptions) to the exclusion of their linguistic comprehension - see following note.
26. If there is no difference between the linguistic abilities of the groups as regards comprehension, then there appear to be good grounds for arguing against the notion that there are any really significant linguistic differences between the groups; this renders the initial part of Piaget's argument all the more difficult to understand.
27. Here we work specifically within a framework which relates directly to the sort of question typically employed by Piaget. I.e., we present "More-or-more" questions, counterbalancing the order of presentation of terms (e.g. "More A or more B" versus "More B or more A", etc.). In addition, for all questions an unstressed form was employed (neither the first nor second term being deliberately

stressed), as was a "normal" intonation contour (i.e. intonation pattern (iii), p. 40) - see Note 12 above.

28. An analogous result is reported by Kohnstamm (1963).
29. The purpose of this reversal of subclass ratios between Cards (i) - (iii) and (iv) - (vi) was to reduce the possibility of obtaining response-biased results. In a comparison of the subclasses of flowers, the correct response to: "Are there more tulips or more daffodils", will be "More tulips" for Card (i), but "More daffodils" for Card (iv). Failure to counterbalance the material might easily lead to misinterpretation of results, for the child might answer as a function of response biases in favour of, say, ease of pronunciation (: it is probably easier for the child to say "tulips" than "daffodils"), or colour preference (: a preference for red rather than yellow), or proximity (: when the cards are placed on the table, one subclass is nearer the child than the other).
30. 8 of these 12 children were selected from a different pre-school nursery than the one which provided subjects for Experiment 7.
31. In both Experiments 7 and 8, there is no evidence of response-biases on comparison of the counterbalanced sets of cards (Cards (i) - (iii) and Cards (iv) - (vi), where subclass ratios are reversed); since this suggests that with this

sort of experiment subjects do not operate under the response-biases that our material was intended to detect, this check is dispensed with in subsequent experiments.

32. It might be argued that the basis of the observed change in results in the present experiment lies not so much in referential clarification of subclass terms, but simply insofar as the subjects tested have already been exposed to this type of experiment (Experiments 7 and 8). However the force of this argument is diminished, for as will become clear, we do not observe an improvement in correct responses general to both minority and majority inclusion questions - rather, we observe an inversion in the response pattern, where (majority) questions previously answered correctly are now answered incorrectly, and vice-versa for minority questions (cf: Table 21, p. 101).
33. At first glance, perhaps our proposals seem just as anomalous/inconsistent as Piaget's, for we are suggesting that "B" is not restricted in subtraction questions ("B" = $A+A'$), restricted to A in minority inclusion questions ("B" = A), and restricted to A' in majority inclusion questions ("B" = A'). However if we can show that all of these cases are subsumed under the same process - of short-term switches in the reference of "B", differentially determined by the context and type of question, then the apparent inconsistencies will disappear.

34. The disagreement between the present account and that of Campbell & Wales is more apparent than real, for they have generalised to the child's performance on inclusion questions from study of the child's initial acquisition of the terms such inclusion questions involve; clearly the former occurs much later than the latter. We might resolve our differences by suggesting that in initial acquisition of the task vocabulary, long-term restrictions do occur, while in later use of these terms (e.g. in class inclusion problems) the task vocabulary, long since acquired, is now subject to short-term restrictions. Of course only further study can indicate whether this is so; but at least these two accounts are not necessarily contradictory.
35. In relation to this type of response, see the discussion of "incompatability" in Wales & Campbell (1970).
36. Cf: Morf (1959: 35) who has observed this sort of solution:
 ((Il y a plus de gobelets on plus de gobelets verts? -
Plus de gobelets verts et jaune (très satisfaite).
 Alors on peut dire qu'il y a plus de gobelets? - Non,
il n'y a que trois jaunes. Mais les gobelets, c'est
 les verts et les jaunes ensemble? - Oui. Qu'est-ce
 qui est plus, les gobelets ou les verts? - Les verts
et jaunes.))

("Are there more cups or more green cups? - More green and yellow cups (very satisfied). Then can one say that there's more cups? - No, there's only three yellow ones. But cups, that's green and yellow ones together? - Yes. Which is more, the cups or the green ones? - The green and yellow ones.")

Thus Morf argues that the child can correctly compare the sum of $A+A'$ with subclass A (i.e. the child can handle $A(A+A')$); but when the question is posed in the form $A(B)$, the child fails to answer correctly (Morf, 1959: 37):

((Même si le sujet n'a pas découvert lui-même la somme $(A+A')$, il l'accepte immédiatement et la compare correctement à la sous-classe A; en revanche, il refuse systématiquement de comparer A à B, comme nous l'avons observé tout au long de nos expériences.))

("Even if S hasn't discovered for himself the sum $(A+A')$ he accepts it immediately and compares it correctly with subclass A; on the other hand, he refuses systematically to compare A with B as we have observed all the way through.")

This would seem to confirm that we have been correct in arguing that the standard inclusion question $A(B)$ is not answered incorrectly because of an inability to compare class and subclass, but rather because of difficulties with the

language associated with class inclusion problems.

37. It might be suggested that adults, faced with the question: "There's more A than what?", would give precisely the answer that the child gives: "There's more A than A'". In relation to the present discussion, the purpose of the question must be considered relative to its context.
38. It might be argued that half the subjects amenable to facilitation should have been assigned to the "implicit correction procedure" and the remainder to a control group which received no such correction; then an experimental versus control group comparison could have been made, lest improvement in performance stems simply from repeated exposure to the task. This design was considered for Experiment 16, but two factors decided against it. First, availability of subjects at the time of testing did not permit the n of experimental/control groups to be increased to a reasonable size. But the second factor was more compelling: namely, the data of Experiment 15 appear to indicate quite clearly that repeated exposure to inclusion problems will not by itself lead to facilitation, for it appears from Experiment 15 that facilitation is an all-or-none phenomenon - the distribution of responses across subjects shows that 13 Ss gave four or five correct responses out of five, and that 5 Ss gave one or no correct responses. When we recall that these latter 5 Ss were not only repeatedly exposed to inclusion problems, but were also implicitly corrected on each successive item,

to no avail, the notion that repeated exposure to inclusion problems can by itself lead to correct responses loses its appeal. This point has been confirmed by Morf (1959).

39. A paper by Ahr & Youniss (1970), encountered six weeks after completion of Experiment 16 above, suggests that the possibility of experimenter effects can be discounted. Ahr & Youniss argue that inclusion questions are reduced to subclass-subclass comparisons through the child's (6-8 years) miscomprehension of the question; in an attempt to prevent such miscomprehension they instituted two training procedures: (a) expanded question training, and (b): correction training. Both training procedures may be described as "explicit" (in contrast with the "implicit correction procedure" employed in the present studies), for on production of an incorrect response, S was explicitly told: "You are wrong. Tell me the right answer." Correction was repeated until S gave the correct answer. When necessary, E prompted S, but E never said the class name; S had to generate it." (Ahr & Youniss, 1970: 139; no indication is given as to the nature of E's prompting.) With procedure (a), where expanded questions were presented as in Experiment 13 above in an attempt to prevent "referential confusion", or, in our terms, restriction of the "B" term to the A' subclass, Ahr & Youniss presented questions like: "Are there more pets (B) or more dogs (A) or more cats (A')?" While this procedure was found to facilitate responses during training itself, there was no facilitation on a

series of subsequent test items; however on these test items, the inclusion questions presented reverted to standard form. With procedure (b), where incorrect responses to standard inclusion questions were corrected in the manner just indicated, facilitation was maintained on a subsequent series of test items presented in standard form. Ahr & Youniss claim that these results indicate that 6-8 year old children can compare class and subclass if given appropriate training. To this extent, their paper therefore suggests that our own results are not simply the result of experimenter effects. However it is interesting to note that Ahr & Youniss make no mention of what the child might be learning during training; nor do they mention the possible relevance of language. From our present studies, it would appear that what the child learns is the way in which the experimenter is employing the terms in inclusion questions - i.e. S is learning the way in which E intends the co-ordination of inclusion question terms with object-referents.

40. When considering perceptual set, it is important to remember that the typical experimental procedure, where an array is presented to the child, probably encourages perceptual set, for inclusion questions are "analytic" - i.e. in order to answer them, one need make no reference to any array: there could not be "more dogs than animals" by virtue of the way in which we (adults) use the language.

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